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REPORT

Matching Up to the Information Society

An Evaluation of the EU, the EU Accession Countries, Switzerland and the United States

Irma Graafland-Essers, Leon Cremonini, Emile Ettedgui, Maarten Botterman

Prepared for the European Commission

RAND EUROPE

SIBIS

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Abstract:

This report presents the current understanding of the advancement of the Information Society within the European Union and countries that are up for accession in 2004, and is based on the SIBIS surveys and analyses per SIBIS theme and country. The report is unique in its coherent and comprehensive approach in measuring the Information Society. It intends to inform policy-makers and citizens on the advancement of the Information Society, further debate and research among the professional statistical community, and lead to an improved statistical competence in measuring the Information Society in Europe. The report focuses on basic access and usage elements like Internet readiness, the digital divide, and information security. It not only considers factors that determine access and usage, such as the perceptions of possible barriers, digital literacy, learning, and training issues, but it also benchmarks on-line applications like e-commerce, e-work, e-science, e-government, and e-health. The report concludes with a summary of recommendations for policy-makers and further research.

Preface

This report is the final Synthesis Report (Deliverable 5.2.2 and 5.2.3) of Work Package 5 (WP5) of the SIBIS project (Statistical Indicators Benchmarking the Information Society), funded by the European Commission under the "Information Society Technology" Programme (IST, 1998-2002).

The overall goal of SIBIS is to develop and test indicators for monitoring progress towards the Information Society, taking account of the 'e-Europe action lines.' On this basis, SIBIS focuses on basic access and usage elements like Internet readiness, the digital divide, and information security. It not only considers factors determining access and usage, such as the perceptions of possible barriers, digital literacy, learning, and training issues, but it also benchmarks on-line applications such as e-commerce, e-work, e-science, e-government, and e-health. The results presented in this report are a timely and direct contribution to benchmark progress on key issues of the information society in general, and the e-Europe initiative in particular.

RAND Europe has prepared this report based on all earlier work by the SIBIS project. However, it is mainly based on the WP5 topic reports, *Highlights 2002: Towards the Information Society in Europe and the US,* and *Pocketbook 2002/3: Measuring the Information Society in the EU, the EU Accession Countries, Switzerland and the US* publications ([1]) that presented the highlights of the topic areas as perceived by spring this year, and the WP5 country reports contributed by accession state partners. All publications of the SIBIS project – including this report – are available in electronic format on the Internet at: www.sibis-eu.org.

SIBIS is led by empirica (Germany), and includes the following project partners: RAND Europe (The Netherlands), Technopolis Ltd. (United Kingdom), Databank Consulting (Italy), Danish Technological Institute (Denmark), Work Research Centre Ltd. (Ireland), University of Applied Sciences Solothurn Northwest Switzerland (Switzerland), Faculty of Social Sciences, University of Ljubljana (Slovenia), ASM Market Research and Analysis Centre (Poland), Budapest University of Economic Sciences and Public Administration (Hungary), Faculty of Management of the Comenius University Bratislava (Slovakia), 'Dunarea de Jos' University (Romania), Institute of Economics at the Bulgarian Academy of Sciences (Bulgaria), Estonian Institute of Economics at Tallinn Technical University (Estonia), Social Policy Unit (Sozialinnen Politicus Group) (Lithuania), Computer Science Institute (Latvia), and SC&C Ltd. (Czech Republic).

This report has been developed with input and feedback from SIBIS partners, and has been peer-reviewed in accordance with RAND's quality assurance standards (see http://www.rand.org/about/standards/).

The views expressed are those of the project team and do not necessarily reflect those of the European Commission. Nothing in this report implies or expresses a warranty of any kind. Results from this report should only be used as guidelines as part of an overall strategy.

For more information, please contact sibis@rand.org or check the web site http://www.sibis-eu.org.

(1) In the remainder of the report these publications should be referred to as Highlights 2002 and Pocketbook 2002/3 respectively.

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ABBREVIATIONS

B2B	Business to Business
B2C	Business to Citizen
B2G	Business to Government
CBNI	Closed Business Network Integration
COQS	Communicating, Obtaining, Questioning, Searching
DIDIX	Digital Divide Index
DL	Digital Literacy
DL	Digital Literacy
DMS	Decision Maker Survey
EC	European Commission
EDI	Electronic Data Interchange
EDT	Electronic Data Transfer
EITO	European Information Technology Observatory
ESS	European Statistical System
EU	European Union
EU15	Average of the 15 EU member states
G2B	Government to Business
G2C	Government to Citizen
G2G	Government to Government
GPS	General Population Survey
ICT	Information and Communication Technology
IS	Information Society
ISDN	Integrated Services Digital Network
IST	Information Society Technology
LFS	Labour Force Survey
NAS	Accession countries; originates from New Accession States
NAS10	Average of the 10 Accession countries
NRN	National Research Network
OECD	Organisation for Economic Co-operation and Development
PAPI	Personal Aided Personal Interview
PIAP	Public Internet Access Point
R&D	Research and Development
SIBIS	Statistical Indicators Benchmarking the Information Society
SMEs	Small and Medium Enterprises
SMS	Short Message Service
SOHO	Small Office Home Office
UK	United Kingdom
US	United States
WWW	World Wide Web
xDSL	Digital Subscriber Line

1 EXECUTIVE SUMMARY

The ongoing pace of change towards a knowledge oriented society has been recognised by the European Commission as a challenge and an opportunity to prepare Europe for a future we want: socially inclusive, economically competitive, and culturally diverse, based on sustained and sustainable growth. In order to achieve progress in a way that is of benefit for all European Union (EU) citizens, all EU Member States and the EU Accession Countries have adopted the ambitious e-Europe initiative.

Rather than assuming a central coordinating role, the European Union embraced the so-called "Open Method of Coordination." This entails measuring progress and identifying good practice in all participating countries. Of equal importance is the presentation of the results on a European level so that participating countries can learn from the practice of other countries, and adapt their speed and approach of progress as they require.

Socio-economic research, as sponsored by the Information Society Technologies (IST) programme under the European Union's 5th Framework Programme of Research and Technology Development, has helped to create this understanding and identify good practice. SIBIS' contribution is important in this.

The overall goal of SIBIS is to develop and pilot indicators for monitoring progress towards the Information Society (IS), taking account of the "e-Europe action lines." On this basis, SIBIS focuses on basic access and usage elements like Internet readiness, the digital divide, and information security. It not only considers factors that determine access and usage, such as the perceptions of possible barriers, digital literacy, learning, and training issues, but it also benchmarks on-line applications like e-commerce, e-work, e-science, e-government, and e-health.

A core set of SIBIS indicators was tested and applied in benchmarking surveys in all 15 Member States, in the United States (US), Switzerland, and the following EU Accession Countries (i.e. the New Accession States - NAS): Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, and Slovakia. The surveys collected robust and representative data for benchmarking purposes that enabled comparisons to be made across the EU Member States and, for the first time, between the EU and the US on exactly the same set of indicators at the same point in time.

The results of the benchmarking surveys have been presented in a series of reports on nine aspects of the Information Society in the EU member states, and a series of country reports on the ten NAS, covering the seven most relevant of the nine aspects of the Information Society.

This report focuses primarily on presenting the main results from the SIBIS benchmarking surveys. The survey fieldwork was carried out in April – May 2002 and January 2003. Annex 1 of this report presents details of the samples and other methodological aspects of the surveys. The questionnaires themselves can be found on the SIBIS website: http://www.sibis-eu.org/statistics/questionnaires.htm.

BASIC ACCESS AND USAGE

Internet Readiness

Within Europe and the US, the development of the Internet is a well-known phenomenon. According to the surveys, 54% of the EU population, and around 77% of the US population, have used the Internet either as a regular user (respondents who used the

Internet in the four weeks prior to the survey), or an occasional user (respondents who used the Internet in the 12 months prior to the survey). In contrast, 73% of the NAS population have never used the Internet, and 11% have never heard of the Internet.

In Europe, most users access the Internet principally from home. However, there is a fast emerging pattern of "bimodal usage", especially in more sophisticated markets: in the US as in Nordic countries, the UK, and the Netherlands there is a large proportion of 'bimodal users' who access the Internet from both at-home, and at-work locations.

Based on experiences of the US and Nordic markets, it has been noted that once a majority of a total population has Internet access there is a migration of users with high tenure (period since first use of the Internet) to faster Internet connections. They seek a better on-line experience such as quicker downloads and "always on" connections.

Mobile telephony is an important, exceptionally fast-growing sector. Although mobile penetration is currently quite high in most western countries, differences occur in usage patterns between countries, as do divergences in the use of data mobile services for communication. SIBIS results show a mobile phone penetration rate that is generally high, almost 70%, across the 15 European Union countries (EU15), whereas in the US, mobile intensity reaches only 56%, and in the 10 Accession countries (NAS10), it is only 34%.

Digital Divides

A digital divide exists between citizens of the EU Member States and those of the Accession Countries. The extent of the digital divide in a given country can be estimated by looking at the PC and Internet participation of groups considered at risk of being excluded. At-risk groups may include the elderly and those with a relatively low level of education, among others. The digital divide index (DIDIX) combines the divides by gender, age, education, and income in relation to computer use, Internet use, and Internet access at home. The DIDIX in the EU Member States compared to the NAS highlights age, income, and education as important factors in determining access to the Internet and PCs. The largest difference in access is between those who have a relatively low level of education and the rest of the population.

Amongst the NAS, Estonia and the Czech Republic show highest values and are not far from the EU15 average. The continued persistence of relatively large digital divides in countries usually considered as 'late adaptors' is apparent. Countries with an observable aggravation of divides rank lower with regard to the ICT uptake.

Information Security

Security concerns have a strong impact on on-line shopping behaviour in Europe as well as in the US. In the EU, for instance, almost 30% of Internet users stated that they would often be stopped from buying on-line because of their concerns. However, it is apparent that divergences exist among countries. Whereas some countries, which could be defined as "front-runners" (e.g. the US and Northern Europe), are affected only in a limited way by their security concerns and have accepted e-commerce as a relatively common practice, the "laggards" (e.g. Mediterranean countries and NAS) show lower than average e-commerce usage and strong impact of security concerns.

In the NAS both e-commerce usage and the effects of security concerns on e-commerce are limited; this could be related to the fact that the share of regular Internet users (and thus e-buyers) is lower than in the EU. If we benchmark individual NAS against the NAS average rather than against the EU average, it appears that, in this case too, the split

between “front-runners” and “laggards” is marked: in some countries, such as Estonia, on-line shopping usage is becoming comparable to what is found in some of the EU Member States; others still have a long way to go (Romania, Latvia, Lithuania).

Countries who lead the way in practicing e-commerce, such as the US, are also the most aware of security features of websites. Countries lagging behind in e-commerce usage (such as most NAS), typically also show low awareness and importance of websites’ security features.

The most widespread information security breaches are computer virus infections. Almost all organisations have been affected by computer viruses in the 12 months prior to the survey. By comparison, the numbers of businesses affected by other security breaches, such as unauthorised access to their networks or identity theft, are fairly low.

FACTORS DETERMINING ACCESS AND USAGE

Perceptions of Possible Barriers

Citizens are strongly concerned both about privacy/confidentiality and data security, with a slightly higher concern about privacy. Generally, among the NAS, concerns about privacy and confidentiality, as well as data security, tend to be lower than within the EU. However, looking at Member States of the EU and at Accession Countries individually, both groups exhibit a great deal of variation. For example, Poland and Latvia are countries where both concerns register higher than in the EU. Similarly, in the Netherlands, France, Austria, and Sweden concerns about privacy and confidentiality are lower than in the Accession Countries as a whole.

Most non-regular Internet users in Europe believe that advanced computing skills are required for using the Internet. However, while in the EU15 less than 60% feel the skill gap as a barrier to Internet usage, this figure is 68% on average in the NAS10, reaching peaks of over 80% in Latvia, Lithuania, the Czech Republic, and Slovakia. In contrast, psychosocial barriers to Internet usage are stronger in more advanced information societies (e.g. Sweden), suggesting limitations to the current growth in Internet penetration levels.

Digital Literacy, Learning, and Training

A significant share of the labour force is participating in work-related lifelong learning. While not giving any information on the type, intensity, and field of these activities, SIBIS results show that a high percentage of workers are in the process of preparing for the adaptation of skills to the fast-changing requirements that are a key feature of the Information Society. At the same time, e-learning can play a decisive role in delivering learning systems which meet the demands of today's workers - and the unemployed. The share of the labour force that uses e-learning is 15% on average in the EU, and 5% in the NAS, both of which is much lower than the 23% reached in the US.

The level of digital literacy (DL), measured by four types of skills in using the Internet (communicating digitally, obtaining and installing digital tools, questioning the source and reliability of information from the Internet, and searching for the required information using search engines) varies strongly within the EU, with the NAS in general as the ones showing the lowest level of DL among the total population. Estonia and Slovenia show a slightly higher level of DL than the Mediterranean countries of the EU and Portugal.

ON-LINE APPLICATIONS

e-commerce

On average, 20% of the EU's population purchases products online. By comparison, only about 5% of the population in the Accession Countries does so. On-line buyers tend to display a more interactive use of the PC than non-on-line buyers, suggesting that the more sophisticated Internet users purchase on-line.

Almost a quarter of Europe's businesses sell online, whether that is through a website or an e-marketplace, and twice as many make on-line purchases. On-line selling activity varies across the three market domains and across the countries analysed. Business-to-Business (B2B) and Business to Consumer (B2C) correlate closely in terms of on-line sales, whereas Business to Government (B2G) is lagging behind. On average, the volume of sales generated via e-commerce are small and tend to form a small portion of total sales turnover.

European businesses vary widely in their levels of engagement with e-commerce. In the seven countries covered in the SIBIS establishment survey, only a very small minority of establishments remain completely off-line, although a further one in five companies only use basic e-mail. For one third of businesses in the countries surveyed, e-commerce engagement involves back-office transactions through closed network business integration (based on the use of extranets or Electronic Data Interchange). More than two in five businesses engage in some level of front-office e-commerce, with this being restricted to web marketing for one in five businesses, and web sales for one in twelve. Just under one in seven businesses engage in both front-office and back-office e-commerce.

e-work

Despite people's strong interest towards telework, home-based telework is not common: just over 7% of workers from the EU, 3% from the NAS and 17% from the US actually telework from home. However, it must be stressed that telework consists of a variety of types apart from home-based telework, including mobile work, centre-based telework, and self-employed teleworkers in a Small-Office-Home-Office (SOHO). Hence, figures are higher when other forms of telework are also taken into account.

Averages, both for the EU and for the NAS, conceal significant differences among different countries. In the EU, home-based telework is common in northern Europe (15-20%), but the Mediterranean area, together with Portugal, barely reaches 5% of intensity. Similarly, although telework is infrequent in the NAS, there are significant disparities between those countries that show a relatively high intensity of home-based telework (8% in Estonia and Lithuania, which are above the EU average), and the others (less than 5%).

In spite of the interest in telework, an extensive shift of work from the office into the home is yet to be seen. Although companies are often willing to give their staff remote access to their computer network, the acceptability of staff working from home whole days seems to be limited. This trend is complemented by the strong increase in mobile teleworking, which means the use of on-line connections for work purposes during business trips.

e-science

Researchers in some disciplines can be considered as avant-garde ICT users in a work environment. Hence, exploring e-science should give clues about future ICT requirements and trends in other areas of society. Although research systems include academic and

private sector research and development (R&D) establishments in principle, SIBIS considered public science, and defines e-science as its penetration with computers and computer networks.

The types of available computers (stand-alone PC, workstation, mainframe, supercomputer, cluster of PCs) and the age of the computer used are the most important indicators to assess the quality of computer equipment. SIBIS data shows that whereas national differences do not play a significant role here, discipline-related divergences are far more pronounced: astronomers and computer scientists appear the most "e-science ready." Chemists are usually at, or a little bit below, the average of all scientific disciplines in the dataset; economists and psychologists rate the readiness indicators worse than the average scientist.

SIBIS assessed to what extent scientists do in fact use e-science tools for their work, either for data collection, analysis, or diffusion of results. Also in this respect, country differences, even though revealing a patchwork of strengths and weaknesses, are less marked than discipline-related differences: astronomers generally use the Internet most often for collecting and analysing data, and retrieving information; but, they do not rely on personal world-wide web (WWW) pages for publishing professional information. On the other hand, much higher percentages of economists, normally not the avant-garde of e-science, and computer scientists have their own WWW pages.

e-government

EU and NAS citizens show a significant preference for some e-government services, that is the interaction with government via electronic means, while for other services the traditional way is still preferred. Regular Internet users would rather turn to the Internet for communicating with their administrations if it did not involve revealing a great deal of personal information (clearly a declaration to the police entails renouncing one's privacy far more than a library book search or a job search). The amount of personal information required is only one explanatory factor for the preferences of citizens. For instance, familiarity with the on-line service, and experience using the Internet, are also likely to play a role.

Typically in countries where Internet usage is higher, citizens prefer to communicate on-line with their governments. However, the enthusiasm towards e-government does not always ensue from its actual implementation or from citizens' on-line access. Romania shows a very high preference for using online services, well above the average of the Accession Countries and higher than all EU member states. Yet, availability and usage of those services in Romania is limited: Romanians are very willing and enthusiastic about the possibilities the Internet can create for them in the future.

e-health

The SIBIS survey found that although online searching for health-related information is still a minority activity in Europe, both amongst Internet users (36.4%) and amongst the general population (19.8%), it is of sufficient scale to represent a significant issue for public health policy in general, and for patient-doctor interaction in particular. There are significant variations across the EU Member States in the prevalence of health-information searching on the Internet, ranging from between 20% to 50% of Internet users and between 10% and 30% of the population. No EU country reached the levels found in the US, where this form of e-health activity was reported by more than half (58.3%) of Internet users, a figure that translates into more that two in five (44.9%) of the US population overall.

Amongst Internet users, males and younger users were less likely to report online searching for health information, and there were few differences across socio-economic groups. However, differences in Internet usage in the first place reveal that older people, and people in less favourable socio-economic circumstances, are a lot less likely to use the Internet to search for health-related information. This indicates a need for careful monitoring of the extent to which the advent of health-related information services on the Internet may exacerbate existing health "divides" in the population.

About one in six EU users reported having to search web sites in languages other than their mother tongue in order to find suitable health-related information. This was significantly higher than the US (English-speaking) response of one in forty users. Language is therefore an important factor to be considered in e-health policy, thus if linguistically-determined health divides are to be avoided, it will be necessary to ensure that sufficient quality information is available for all language groups.

CONCLUSIONS

SIBIS was conceived with the aim of measuring the developments of the Information Society by combining the three levels of IS development: readiness, intensity, and impact. The results of the SIBIS project point to important aspects of the IS that provide a necessary complement to existing measures of progress in the IS. Up to now, evaluations of the Information Society have focused primarily on the supply side, looking at whether services are available, and how sophisticated they are. SIBIS measures whether the services are used, to what extent, and why or why not. As a result of SIBIS, it is fair to say that we have today a clearer picture of how Europe is progressing towards becoming the most competitive and dynamic economy of the world. For e-commerce and e-government this is certainly true.

SIBIS also reveals regional differences in the advancement of the Information Society. Overall, the US leads the way, with high Internet penetration and experience. Northern Europe, however, often has even higher figures. SIBIS shows that, overall, the Accession countries still have a long way to go to reach current EU levels, although, significant differences were measured between the Accession countries, and, in fact, leading countries there perform better than the lagging countries of the EU.

The purpose of SIBIS was to test and pilot indicators, which should be used in larger, more comprehensive surveys. The results obtained are very promising, though they still present certain limitations. This issue is considered in more detail in other SIBIS products - in particular the *Indicator Handbook* – where the “best” indicators are given – even when these were not the ones actually tested and piloted within SIBIS.

2 INTRODUCTION

Statistical Indicators Benchmarking the Information Society (SIBIS) is an IST Programme project aiming to produce new methods and data that will contribute to the European effort to measure and benchmark the Information Society (IS). As the Information Society extends to all aspects of social and economic life, good indicators are needed to track its evolution and its impacts.

SIBIS has approached the task of developing and testing such indicators in a systematic manner. To begin with, an assessment was made of the state-of-the-art in Information Society benchmarking. Available indicators were collected and analysed, including ones that have been used for actual benchmarking purposes, ones that have been used in small-scale and non-representative studies, and ones that have been proposed but not yet applied in practice.

A core set of SIBIS indicators were then developed, with the emphasis on those aspects of the Information Society that have been the focus of attention in the e-Europe context. These indicators were tested and applied in benchmarking surveys in all 15 EU Member States, as well as the US, Switzerland, and the following EU accession countries (i.e. the Newly Associated States - NAS): Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia, and Slovakia.

The surveys collected robust and representative data for benchmarking purposes, enabling comparisons to be made across the EU Member States and, for the first time, between the EU and US on exactly the same set of indicators at the same point in time.(2)

The SIBIS work on indicator development and testing has helped advance the understanding of what and how aspects of the Information Society should be benchmarked. This is currently being used in an evaluation of the e-Europe 2005 benchmarking proposals.

Apart from this direct contribution to the e-Europe exercise, SIBIS will also make the methodological developments from its work more generally available for others to use. To facilitate this, the SIBIS indicators are compiled into a handbook to support the benchmarking activities of the EU and national agencies.

This report focuses primarily on presenting the main results from the SIBIS benchmarking surveys. The survey fieldwork was carried out in April – May 2002 and January 2003. A representative General Population Survey (GPS) was conducted in 2002 in all 15 EU Member States, as well as Switzerland and the US, involving a total achieved sample size of 11,832, and in the above 10 accession countries in 2003, involving a total sample size of 10,407. A representative survey of establishments – the Decision Maker Survey (DMS) - covered 7 EU Member States, including the five largest Member States (Germany, Spain, France, Italy and the UK) as well as Finland, expected to be an Information Society frontrunner, and Greece, expected to be less well advanced. This involved a total achieved sample size of 3,139 establishments. Annex 1 of this report presents details of the samples and other methodological aspects of the surveys. The questionnaires themselves can be found in on the SIBIS website: http://www.sibis-eu.org/statistics/questionnaires.htm.

The results of the benchmarking surveys have been presented in a series of reports on nine aspects of the Information Society in the EU member states and a series of country

(2) As the US is so large, and differences between states are quite likely, the ideal survey would compare the US states with the European countries. However, this was not possible within the scope of the SIBIS project.

reports on the ten accession countries covering seven aspects of the Information Society. A list of these reports follows below with authors in brackets.

Topic Reports EU Member States:	Country Reports NAS:
Telecommunications and Access *(Technopolis)* **Internet for Research and Development** *(University of Applied Sciences Solothurn)* **Security and Trust** *(RAND Europe)* **Education** *(Danish Technological Institute)* **Work, Employment, and Skills** *(empirica)* **Social Inclusion** *(Work Research Centre)* **eCommerce** *(Databank Consulting)* **eGovernment** *(RAND Europe)* **eHealth** *(Work Research Centre)*	**Bulgaria** *(Institute of Economics at the Bulgarian Academy of Sciences)* **Czech Republic** *(SC&C Ltd.)* **Estonia** *(Estonian Institute of Economics at Tallinn Technical University)* **Hungary** *(Budapest University of Economic Sciences and Public Administration)* **Lithuania** *(Social Policy Unit (Sozialinnen Politicus Group))* **Latvia** *(Computer Science Institute)* **Poland** *(ASM Market Research and Analysis Centre)* **Romania** *('Dunarea de Jos' University)* **Slovenia** *(Faculty of Social Sciences, University of Ljubljana)* ***Slovakia*** *(Faculty of Management of the Comenius University Bratislava)*
Full reports can be found on the SIBIS website http://www.sibis-eu.org/. *Full details about the project partners can be found in ANNEX2 (page 65)*	

This synthesis report draws on these topic and country reports, the published *Highlights* document and *Pocketbook 2002/3,* as well as the simultaneously developed *Indicator Handbook*, to present an integrated portrait of the Information Society in Europe, the accession countries, Switzerland, and the US.

3 BASIC ACCESS AND USAGE

3.1 Internet Readiness

Telecommunications infrastructure and access to Information and Communisation Technologies (ICT)([3]) are physical cornerstones of the information society and are both wide-ranging and "horizontal" in nature.([4]) In many ways it can be considered as the fundamental "enabler" – it allows the other e-Europe domains to "happen." Within SIBIS, telecommunications infrastructure has been interpreted very broadly to include all the networks (cable, mobile, Internet, as well as copper wire) over which all types of information (voice, data, sound, image) are carried. Thus, although the main focus is on telephony networks, other forms of transmission, such as computer networks, the Internet, cable (TV as well as telephony), and wireless, are also included.

In Europe, the focus of the Information Society is changing from a concentration on basic issues, such as access to infrastructure, to a consideration of more complex issues like e-readiness, both for businesses and for citizens. Basic infrastructure is much easier to measure than the many dimensions and factors associated with what is now needed to be part of the digital economy. The multifaceted nature of Internet availability, support, content availability, the right kinds of skills, and the right attitude to technology has given rise to numerous new definitions of e-readiness.

The ICT infrastructure indicators presented within SIBIS centre on what has been – to date – among the most important e-Europe policy goals: to boost the development, the extensiveness, and the take-up of broadband technologies, as well as ensuring the competitiveness of the broadband markets for both residential and business markets.

Broadband is probably the single most important enabling technological development of current time. Therefore, it is imperative to measure not only who has access to it, but also for what it is being used. One of the principal features of broadband in Europe is its diversity; there are many broadband access methods, subscription rates, and extensive broadband infrastructures available across the different countries.

The definitions of citizen's readiness tend to be centred on issues of availability, awareness of use, access, content, and skills, for the individual. Business readiness is more complex. One much quoted definition from the Organisation for Economic Co-operation and Development (OECD) for e-commerce is 'the capability to engage in electronic transactions.'([5]) This is just one part of e-readiness; there are issues of transactions, and the connectivity and relationships between employers and employees. There are also the transactions and connections across a supply chain, between suppliers and distributors, and consumers. Readiness also covers the internal processes of an organisation including the relationships between individuals and organisations. All of these areas rely upon organisations having the appropriate access and understanding of ICTs in order to profit from ICTs in the business setting.

Within SIBIS, ICT availability and access is considered from the user's viewpoint. Focusing on consumers, this highlights two aspects. The first aspect studies multi-context users of the Internet - or those who access the Internet from more than one location, for example, at home, at work, at a Public Internet Access Point (PIAP), and so on. The second aspect

(3) In this report Information Communication Technology (ICT) and Information Technology (IT) are synonyms.
(4) Although at the start of the project "Telecommunications and Access" was considered as a separate topic, it has become clear that this topic relates to all the other topics dealt with in SIBIS, e.g. it is the basic foundation for all the other topics.
(5) Colecchia, A.; Pattinson, B.; Atrostic, B. K. (2000), *Defining and Measuring Electronic Commerce*. OECD discussion paper, Paris.

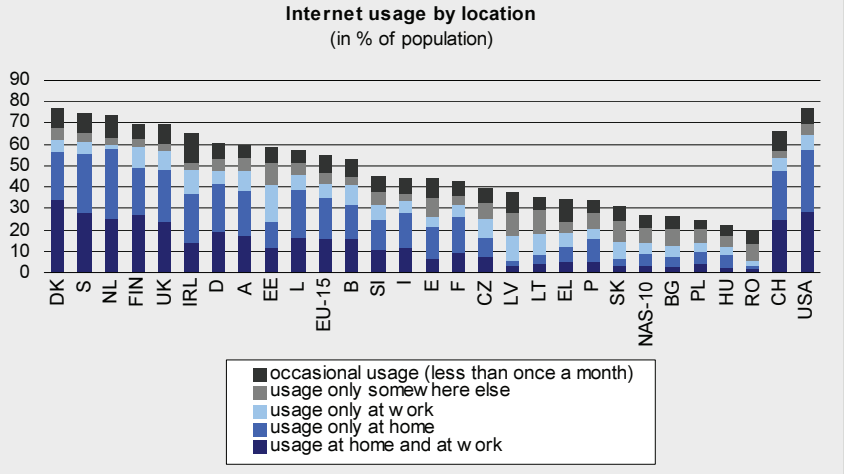
is the availability and use of some of Internet access devices, not only the common access devices like dial up modems, but also the newer devices like platforms such as Digital TV, game consoles, or the mobile phone. These new devices are gradually becoming available in Europe and the US, and have been developed in order to facilitate an "always on" culture, both for information services and for buying and selling – a larger networking effect. This means that access to services through other devices will facilitate the improvement and the impact of the IS.

Looking at readiness regarding businesses instead of citizens, the focus is on e-business, or participation in aspects of e-commerce. This requires more than just access to the Internet, and needs businesses to invest in software and other forms of hardware (e.g. routers' readiness). Central to readiness is the co-presence of main ICT technologies within an organisation, as well as the level of accessibility which a company's website has (i.e. the company has designed the corporate/ commerce website following formal accessibility guidelines so that everyone can potentially access it).

This section considers indicators regarding the level of ICT implementation - a necessary step towards doing e-commerce or e-procurement activities. Section 5.1 of the report concentrates exclusively on more sophisticated e-commerce indicators. These will look at "intensity" and "impact" of e-business, rather than merely measurements of the readiness to do business.

Within Europe and the US, the Internet is a well-known phenomenon. According to the surveys, 54% of the EU population, and around 77% of the US population, have used the Internet either as a regular user(6) or an occasional user.(7) In contrast, 73% of the NAS population have never used the Internet, and 11 % have never heard of the Internet.

Generally, countries with a high penetration of at-home and at-work Internet users are those countries with a more experienced Internet population. Respondents in these countries reported lower level of access from "other locations" than at-home/at-work, and less "occasional usage." In less mature Internet countries many users do not have at-home connections, showing a higher proportion of people accessing the Internet from non-home locations. Likewise, as outlined in Figure 1, occasional usage is more common.



In Europe, most users access the Internet principally from home. However, there is a fast emerging pattern of "bimodal usage", especially in more sophisticated markets. In the US as in Nordic countries, the UK, and the Netherlands there is a large proportion of "bimodal users" who access the Internet from both at-home, and at-work locations.

Figure 1 – Internet Usage by Location
Base: all respondents, weighted

(6) Respondent used the Internet in the last 4 weeks.
(7) Respondent used the Internet in the last 12 months.

Dial up modems are still the most popular method of at-home connection. SIBIS classified this as narrowband (less than 64Kbit/s). ISDN has been classified as mid-band, and the definition of broadband has followed EITO's approach looking at the type of technology used, rather than establishing a speed threshold. Hence, satellite, cable modem, xDSL, leased line, fibre, and multiplex (T1/T3) have been included as broadband technologies.

Based on experiences of the US and Nordic markets, it has been noted that once a majority of a total population has Internet access, there is a migration of users who have been using the Internet for a long time (long tenure); they seek a better on-line experience e.g. quicker downloads, always on connections (Figure 2).

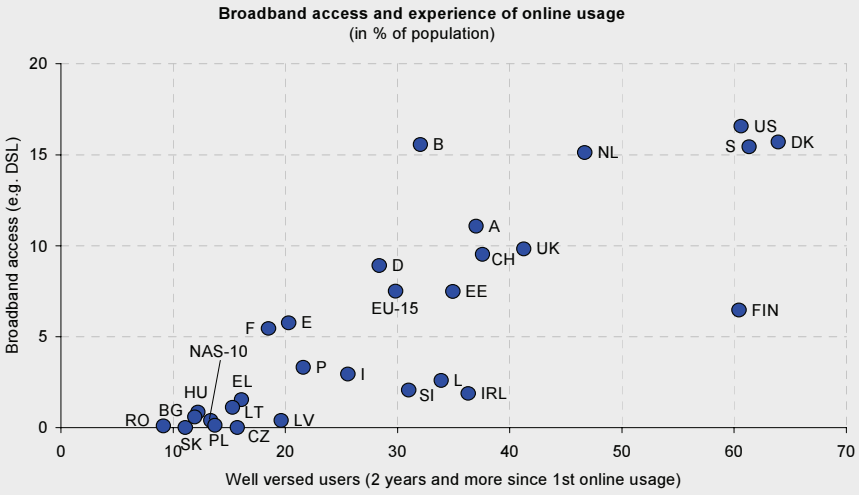
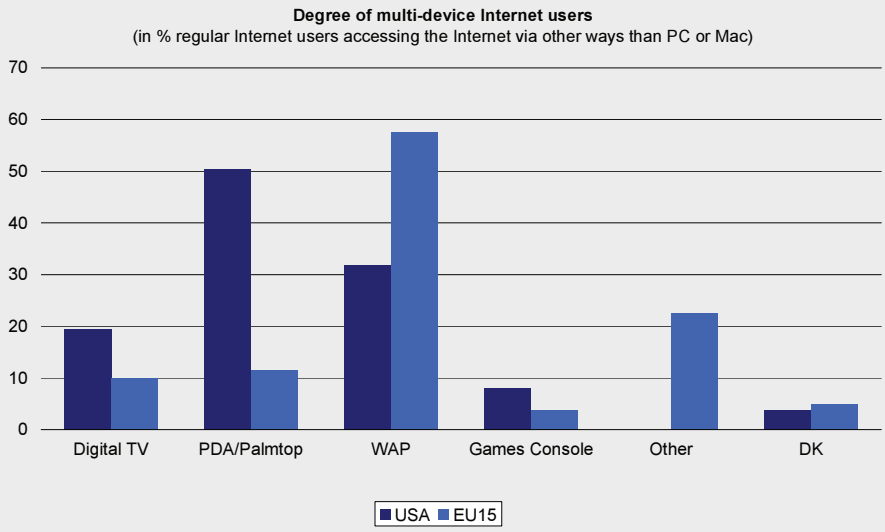


Figure 2 – Broadband Access Versus Level of Tenured Internet Users
Base: all respondents, weighted

The US, Sweden, and Denmark show a relatively high percentage of tenured Internet users, and high percentages of broadband connections. The Netherlands and Belgium register similar broadband levels, despite having a lower level of tenured Internet users. Finland shows the opposite with high levels of "on-line tenure" and low levels of broadband access. Within the NAS, generally showing low levels of both "on-line tenure" and broadband connections, Estonia is a remarkable outsider with an even higher average than the EU15.

Within the e-Europe 2005 target, emphasis has been put on the potential that alternative platforms have, as a way of expanding the persuasiveness of the Information Society beyond the realms of PCs. For Europe and the US, SIBIS examined the degree to which different devices are being used for Internet connections. The data, as illustrated in Figure 3, suggests that there are emergent patterns of bimodal usage.([8])

(8) The "other" category seems to be quite high. There can be several reasons for this, including semantic confusion, like not counting a "laptop" as a PC.



In the US, at-home users are consistently accessing the Internet through more platforms than in the EU. This is particularly true for PDA/Palmtop and digital television access. Digital television access is twice as high in the US as in the EU. Likewise, access through PDA/Palmtop devices is four times higher. The results reverse for mobile phones where the EU shows higher rates of WAP Internet access than the US.

Figure 3 – Internet Access at Home from Alternative Devices
Base: Regular Internet users accessing the Internet by any other way than PC or Mac, weighted

Mobile telephony is an important, exceptionally fast-growing sector. Although mobile penetration is currently quite high in most western countries, differences in usage patterns between countries occur, as do divergences in the use of data mobile services for communication. SIBIS results reveal a mobile phone penetration rate that is generally high across the EU15 countries (almost 70%), whereas in the US mobile intensity only reaches 56%, and in the NAS10 it is only 34% (Figure 4).

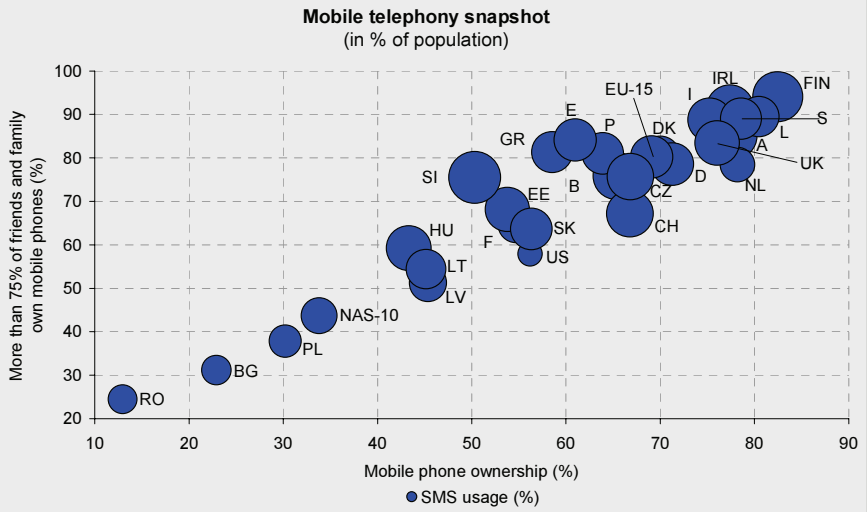
Furthermore, results have indicated that SMSs([9]) are generally popular across mobile phone owners younger than 50 years old. This is especially true for mobile phone owners younger than 25, since the majority of them (80%) have used SMSs in the last four weeks.

The most popular use of SMS is for communication with people.([10]) Apart from voice calls, SMS is currently the most widely available communication service on a mobile phone. This is an area of technological advancement where it will quickly become imperative to measure new emerging technological innovations and other types of services on offer, both via SMS and through other channels.

Although there is some tendency for countries with greater mobile penetration to have more usage of SMS by mobile phone owners, there is enough divergence to suggest that other factors also play a role. Some countries, like Belgium and Switzerland have high levels of SMS usage, while some countries, like the Netherlands, Sweden, and Luxembourg have low levels of SMS usage. In addition, though French people demonstrate a more or less similar level of mobile phone ownership, they are a lot more likely to be SMS users than their US counterparts.

(9) Short Message Service: a service available on digital networks, typically enabling messages with up to 160 characters to be sent or received via the message centre of a network operator to a subscriber's mobile phone.

(10) Other usage options are for example payments for purchases, downloads, ringtones, or receiving subscription services.



In some countries, voice calls are widely used and in other countries data calls are more common. Similarly, at the time of the SIBIS survey phase both France and the US were clearly behind the rest of the Western European countries in terms of mobile intensity penetration and usage. Further behind are most of the candidate countries with the exception of the Czech Republic, Slovakia, Estonia, and Slovenia.

Figure 4 – Mobile Phone Ownership, SMS Usage and Mobile Phone Usage of Friends and Relatives
Base: all respondents, weighted

Conclusions

Progress in the field of telecommunications infrastructure and access to ICT was being measured long before the advent of the Information Society and e-Europe. It is only in recent years that measurements have started to change from systems of basic counting of instances (of technology take-up), to ones which look at the usage and impact that benefit society as a whole.

The work undertaken at the beginning of the SIBIS project confirmed that although many basic quantitative indicators were already available across Europe, these were not always utilized in a consistent and coherent manner. Also, there was no specific pan-European methodological approach to the understanding of telecommunications infrastructure and access to ICT.

Before the start of the SIBIS project, the concentration on the development of indicators was on tracking the “penetration of technologies” and on “access levels” (so-called “readiness” indicators). This indicated there was an enormous scope for development of indicators that would measure what this access really means, and what patterns of use of new technologies exist. There was even less information available on the impact of the use of new technologies.

Within the context of the SIBIS project, some of these more “extended” questions about citizens' use and impact of new technologies have been addressed. Also, all the indicators that have been developed as part of SIBIS in this area have been developed and tested in a consistent methodological way across all 15 EU member states, the 10 Accession countries, and the US.

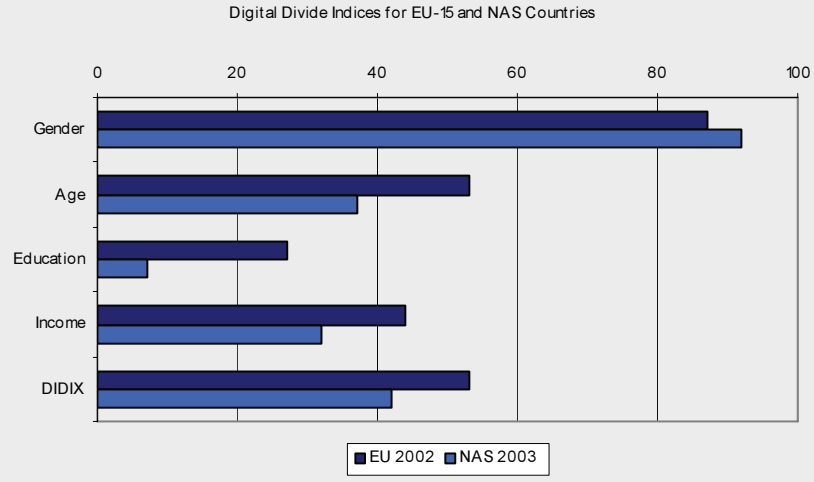
Many of these indicators relate to the priorities set for e-Europe2005 and can be used to inform policy decision-making: to benchmark and to monitor the effects on regulation. The SIBIS benchmarking results not only emphasize the value of the quantitative results obtained through the SIBIS project when doing comparisons across the EU15 member states, NAS10, Switzerland, and the US, but they also provide a qualitative insight into the usefulness, validity, and constraints of indicators on telecommunications and access to ICT.

In conclusion, the SIBIS survey, and subsequent desk research shows evidence of national differences and great disparities across Europe. There are some large differences in Internet usage, adoption rates, mobile penetration and mobile data, and SMS usage, particularly between Northern European countries, Mediterranean countries, and the Accession countries.

3.2 Digital Divides

As the information society becomes more pervasive, debates on whether certain categories are (or are at risk to be) excluded gain strength. The rationale for researching the digital divide is traced back to the implicit assumption that the lack of access and potential for voluntary participation can confer disadvantages, or compound them, where these are already present. It is also important to establish whether, and to what extent, the digital divide coincides with other "existing" socio-economic divides and social inequalities.

It is clear that a digital divide exists between citizens of the EU Member States and those of the accession countries. The extent of the digital divide in a given country can be estimated by looking at the PC and Internet participation of groups considered at risk of being excluded. At-risk groups may include the elderly, those with a relatively low level of education, among others. The digital divide index (DIDIX, Figure 5) combines the divides by gender, age, education, and income in relation to computer use, Internet use, and Internet access at home. It measures the relative adoption of ICT by potentially deprived societal groups – relative compared to the population as a whole. The lower the DIDIX value, the greater the gap between the risk group and the population average. If the ICT adoption rate of a risk group equals that of the population average, then the DIDIX value would be 100.



The Digital Divide Index in the EU Member States compared to the NAS highlights age, income, and education as important factors in determining access to the Internet and PCs. The largest difference in access is between those who have a relatively low level of education and the rest of the population. This holds true in the EU and in the NAS.

Figure 5 – Digital Divide Index Across the EU and the NAS.
Base: all respondents, weighted percentages

The extent of the digital divide differs for each of the at-risk groups, and is illustrated by the values of corresponding indices. The gender divide appears greater in the EU than in the Accession countries. Based on other risk factors, the extent of the digital divide is greater in the Accession countries than in the EU countries. The most apparent divide is in relation to education. The age at which people left school turns out to be the major determinant, and the most powerful predictor in multivariate analyses of ICT usage. ICT diffusion among people having left school under the age of 16 is only about one fourth of that in the whole

population, and even when allowing for the fact that older people are on average less well educated than younger people, education appears to exert greater effects than age.

Time series data for DIDIX, based on SIBIS and earlier Eurobarometer surveys, illustrates that the overall magnitude of the digital divide in Europe has remained more or less constant at a DIDIX value of about 50 since 1997, as shown in Figure 6. This means that ICT uptake amongst the combined at risk groups has remained only half as advanced as it is in the whole population. However, there are indications of changes in some of the specific divides.

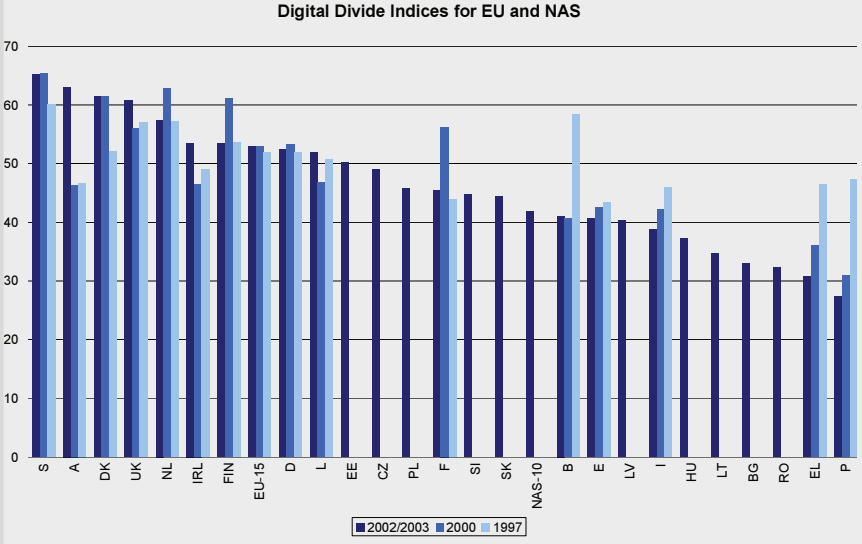


Figure 6 – The Digital Divide Index in the EU and NAS
Base: all respondents, weighted percentages

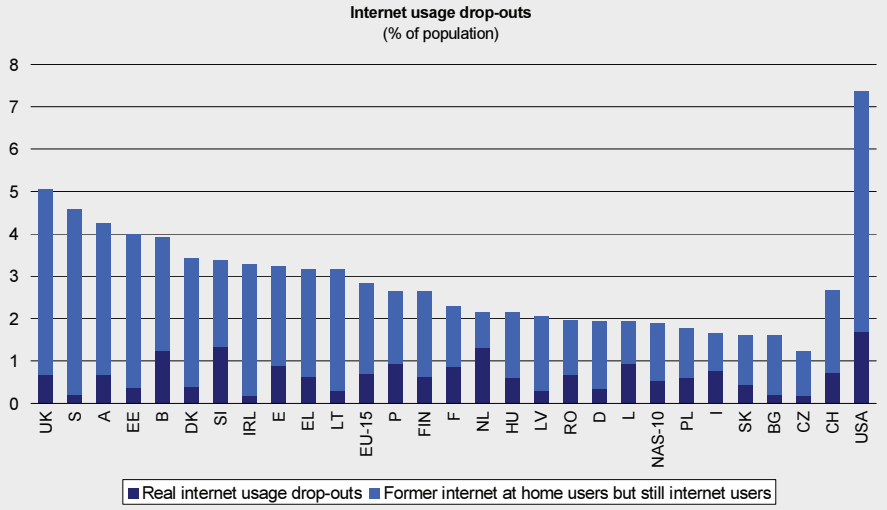
A digital divide remains between those countries viewed as relatively late adopters and others. Identified at-risk groups show a lower propensity for using PC and Internet services than the general population. This percentage is shown for each country surveyed. The NAS rank amongst the lower half of EU Member States. Estonia and the Czech Republic show the highest values among the NAS, and are not far from the EU15 average.

The continued persistence of relatively large digital divides in countries usually considered “late adaptors” is apparent. On the other hand, the fact that some marked improvements are possible, over a relatively short period of time, has been demonstrated by the case of Austria and Ireland. Countries with an observable aggravation of divides are those ranking lower with regard to ICT uptake. The accession countries do not lag behind very much but can be found amongst the lower half of EU Member States. Estonia and the Czech Republic show highest values, and are not far from the EU15 average. At the national level, progress in overcoming the digital divide can, and has been, made (e.g. most notably in Austria, but also in Germany and Ireland) this divide is set to remain one of the most relevant policy challenges at the national level. Accession Countries seriously lag behind in this regard. On the other hand, low values even in apparently advanced information society countries (e.g. the Netherlands, Finland and Denmark), point towards societal challenges but the findings (i.e. index values) are partly attributable to the smaller size of the low education groups in these countries.([11])

The fraction of Internet users who renounce Internet access is a crucial indicator of the direction that today’s Information Society is taking. Clearly, the more people who decide not to participate in the IS, the less inclusive it becomes. SIBIS measures Internet usage drop-outs under a double perspective: real drop-outs are individuals forgoing Internet at-home access, neither using the Internet in the last four weeks nor in the last year from an alternative access point, while all other drop-outs are former Internet at-home users who decided to have access elsewhere. All over Europe and the US, drop-outs are the exception rather than the rule (less than 10%), indicating that the current levels of Internet

(11) More details about this analysis can be found in reference [6]

usage are rather sustainable, although there is a clear prevalence of former at-home users as opposed to real drop-outs (Figure 7).



The Internet users drop-outs indicator aims to gauge sustainability of participation, at the individual level, in the Information Society. It is possible to capture this sustainability both in terms of the population of Internet users, and at the level of general population (the latter is depicted). While it is encouraging to see that those who sever their online connectivity are, by and large, outnumbered by those who merely replace the home access with access from elsewhere, it is nevertheless important to bear the relevance of home access, not least given that it facilitates and encourages the participation for all at the level of a household.

Figure 7 – Internet Usage Drop-Outs (% of population)
Base: all respondents, weighted column percentages

Conclusions

All must have an opportunity to participate in the information society. For this reason, it is important to identify whether an information divide exists between the EU and the NAS, and what might be the causes for this divide. This study has found that a significant divide exists between NAS and EU Member States. Countries with higher levels of Internet penetration show less pronounced digital divides. Some Accession Countries are closer to EU countries. However, this may be due to the relatively long time digital service has been available in EU countries. An important concern is the extent to which the digital divide, in some countries, derives from relatively lower levels of education. Data on educational attainment points to the greater divide that exists between countries where a higher percentage of the population has had to leave school early.

3.3 Information Security

Information and network security are increasingly recognised as crucial elements for ensuring wide participation in the Information Society. Citizens, businesses, and governments alike can enjoy significant benefits because of a secure on-line environment. As innovative business models are being developed to exploit the positive functionalities provided by these new global communication and information media, concerns about the security and privacy of information infrastructures and services may inhibit their full take-up. These concerns may hamper users' trust towards these new information and communication instruments. Also, the e-Europe 2005 Action Plan stresses the importance of on-line security and trust for the Information Society's development.

While the importance of a secure information infrastructure was not disputed, before SIBIS, data on such issues was scarce. Some attempts to measure issues of information security (such as occurrence of breaches, their seriousness etc.) had been made, but they were not focused on the EU and the NAS, and were typically conducted on-line, thus

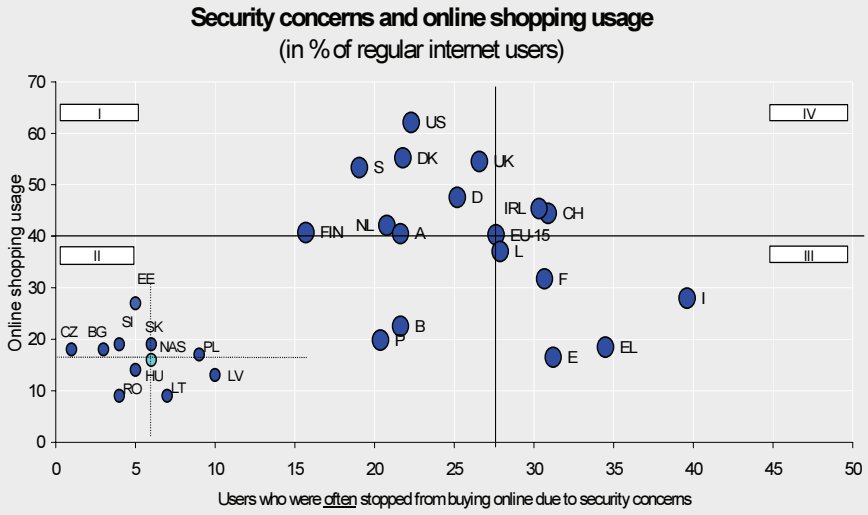
excluding persons with limited Internet access. SIBIS represents a first attempt to correct this data gap.

Citizens are key stakeholders of the European IS and the subjects of e-inclusion. Their perceptions of security and the protection of their privacy on-line have significant implications for the development of e-commerce. If individuals are suspicious, and, therefore, reluctant to send the identifying or financial information required for completing transactions over the Internet, the fraction of commercial and societal activities that can benefit from transition to the electronic medium will be significantly restricted. Businesses are also crucial stakeholders. In part, businesses have similar concerns and problems as consumers with regard to security. There is also on one hand, the issue of guaranteeing privacy, while on the other hand, wanting to benefit from micro data on customers (such as purchasing behaviours). Collecting such data is attractive in order to target customers and predict market behaviour more accurately, but it may backfire as potential consumers may want to opt out of this process, and, in certain cases, it even violates EU Directives on privacy.

From what has been said above, it is clear that enhancements in on-line security are crucial for fostering on-line trust, which in turn is a necessary support for companies' efforts to increase their on-line transaction activities. Hence, the measurements of Business-to-Consumer (B2C) intensity and of security are correlated. Moreover, information security management, as well as technical solutions, are necessary conditions for the establishment of a successful and fully compliant on-line commercial activity. It is clear then, that information security is a pivotal element for prompting the delivery of services and goods on-line, as also shown by indicators measuring self-assessed impacts of on-line sales and purchases. Finally, information security is also essential to support new forms of interactions between employers and employees through processes and applications such as telework or on-line training facilities.

Figure 8 below, drawn from SIBIS GPS data, shows that security concerns do indeed have a strong impact on on-line shopping behaviour in Europe as well as in the US. In the EU, for instance, almost 30% of Internet users stated that they would often be stopped from buying on-line because of their security concerns. However, it is apparent that divergences exist among countries. Whereas some countries, which could be defined as "front-runners," are affected in a limited way by their security concerns and have accepted e-commerce as a relatively common practice (Quadrant I), others, the "laggards," show lower than average e-commerce usage, and a strong impact of security concerns (Quadrant III).

Benchmarking all countries against the EU average, shows that northern Europe together with the US are the "front-runners," while Mediterranean countries still lag behind. All of the NAS fall into quadrant II, where both e-commerce and the effects of security concerns on e-commerce are limited. This could be related to the fact that the share of regular Internet users (and thus e-buyers) is lower in the NAS than in the EU. If we benchmark individual NAS against the NAS as a whole, rather than against the EU average, it appears that, in this case too, the split between "front-runners" and "laggards" is marked: in some countries, such as Estonia, on-line shopping usage is becoming comparable to what is found in some of the EU Member States; others still have a long way to go (Romania, Latvia, Lithuania).



In Northern Europe and the US, e-commerce is relatively common (62% in the US, 53% in Sweden, 55% in Denmark, etc.), and the effects of security concerns on e-commerce are mild (22% in the US, 19% in Sweden, 22% in Denmark, 16% Finland etc.). Mediterranean countries, with low e-commerce and strong concerns, lag behind (e-commerce is 16% in Spain, 18% in Greece, 28% in Italy, and 32% in France 32%, but 31% of Spanish, 34% of Greek, 40% of Italian, and 31% of French Internet users are often stopped from buying on-line because of their security concerns). In the NAS, both on-line shopping use and the effect of security concerns is low . However, some countries, such as Estonia are on their way towards being "front-runners" (here e-commerce reaches 27% of Internet users, while only 5% are stopped because of their concerns).

Figure 8 – Security Concerns and On-line Shopping Usage
Base: Regular Internet users, weighted

From what has been said above, it is clear that, in spite of significant differences, people's concerns are potentially discouraging for those who wish to buy on-line. Yet, security features of websites, such as the deployment of anti-virus protection or secure encryption, might be a way of addressing these concerns. Hence, it is crucial to assess whether or not citizens know about the existence of such features, and to what extent they consider them while doing e-commerce. Most e-buyers are aware of security features of websites, and take them into account when deciding whether or not to shop on-line. However, figures are considerably lower with regards to the larger population, suggesting that at this time electronic commerce represents no more than a niche for most national economies.

Figure 9 below shows that the fraction of individuals who are aware of, and take into consideration, these features is highest in those countries that lead the way in e-commerce (the US, the UK, and Northern Europe), and lowest where the practice of e-commerce still lags behind (mainly the Mediterranean area and the NAS- with the exception of Estonia).

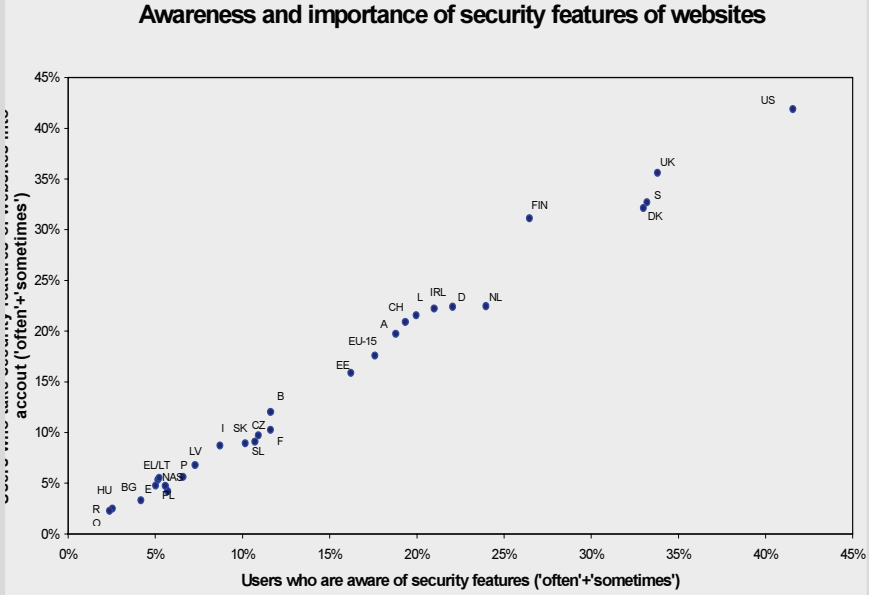
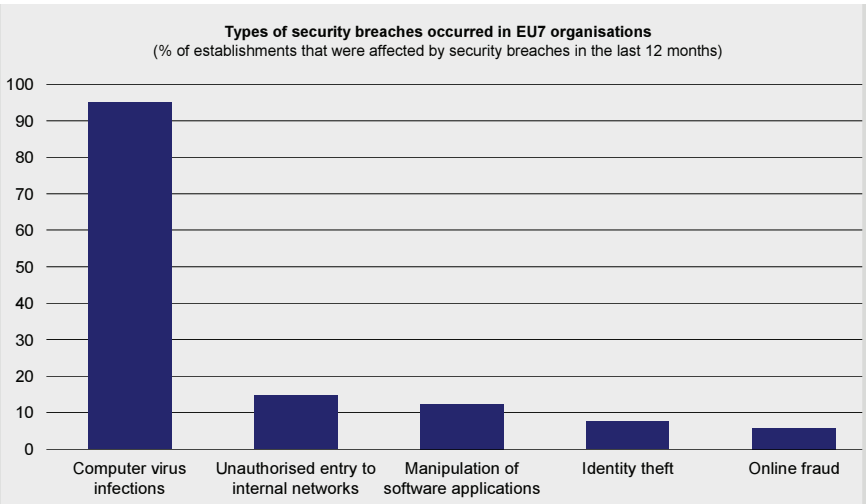


Figure 9 – Information Security Breaches During the Preceding 12 Months
Base: Establishments with on-line presence, weighted column percentages

The US, who lead the way in practicing e-commerce, are also the most aware of security features of websites and often take them into account (42% in both cases). Countries lagging behind in e-commerce usage (such as most NAS), typically also show low awareness and importance of security features of websites (6% on average in the NAS). Estonia again appears to be a "NAS front runner", with 16% of Internet users aware of, and giving importance to, security features of websites (which is more than the Mediterranean countries of the EU).

Business owners share with consumers worries about on-line security. Although most EU businesses do adopt some form of information security policy, between 13% (Greece) and 43% (Finland) of organisations have suffered at least some sort of security breaches in the year prior to the SIBIS survey. A more detailed examination of security breaches reveals that computer virus infections are, in fact, more common. The number of other security breaches reported, such as unauthorised access to their networks or identity theft was relatively low. However, this does not reveal any of the financial effects for the business itself, which could have been massive. Figure 10 shows that, on average among the seven surveyed countries, over 90% of establishments that had been attacked, had in fact suffered viruses. There are no significant differences per country.



The most widespread information security breaches are computer virus infections. Almost all organisations have been affected by computer viruses in the 12 months prior to the survey. By comparison, the numbers of businesses affected by other security breaches, such as unauthorised access to their networks or identity theft, are fairly low.

Figure 10 – Information Security Breaches During the Preceding 12 Months
Base: Establishments that were affected by security breaches in the last 12 months, weighted percentages, multi-response

Conclusions

The importance of network security is, today, undisputed. A certain level of security is necessary to encourage businesses and citizens to go on-line and foster e-commerce, e-government and, generally, a truly inclusive Information Society. Hence, citizens and businesses share concerns about security and trust of on-line services. As seen in the case of citizens, this concern can influence their on-line shopping behaviour. Once they are on-line, they gain experience and knowledge, thereby acquiring more awareness and understanding of security issues. Compared to their counterparts in the EU countries, respondents from Accession Countries tend to be less concerned about on-line security, but also less likely to engage in on-line shopping, likely because on-line services are at an earlier stage of development than in the EU. Looking at select EU countries the reported frequency of on-line security breaches varies significantly. In countries with fewer security breaches, this appears to result from the lower frequency of on-line usage. The most likely type of breach is infection by a computer virus.

4 FACTORS DETERMINING ACCESS AND USAGE

4.1 Perceptions of Possible Barriers

As outlined above, widespread inclusion in the Information Society is possible only under conditions of information and network security, which are necessary to foster trust in electronic commerce and e-government services. Citizens are key stakeholders of the IS; as receivers of on-line services and tools, assessing their perceptions of on-line security and access barriers is essential to ensure that the IS does not exclude any given social group. For example, it is acknowledged that a lack of trust and confidence in services provided electronically is a significant obstacle to the development of e-government; moreover, as seen in section 3.3, electronic commerce can be inhibited by security and privacy concerns. In these cases, the individual, who is in fact excluded from the new possibilities enabled by the electronic means, suffers along with administrations and businesses. Hence, insufficient protection (or a perception of insufficient protection) of personal privacy and security in these systems is a potentially serious impediment in the development of the information society and, therefore, is important from the policy perspective.

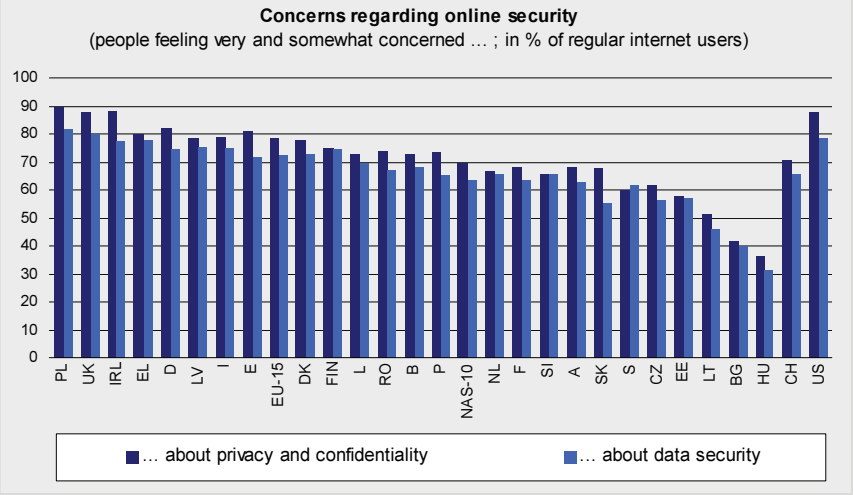
Individuals might be prevented from participating in the IS for a number of reasons. SIBIS developed indicators that assess to what extent citizens in Europe and the US feel concerned about on-line security, privacy, and confidentiality, and what elements are felt as being a particular impediment to effective Internet access.

Aside from the effects on e-commerce (see section 3.3 above), concerns regarding data security and privacy on-line can also be symptomatic of people's trust towards on-line environments. At the outset of this project, SIBIS argued that the specific issue of "trust" was not suitable for benchmarking. In other words, it did not appear possible to measure "trust" as such because it is a subjective perception on the part of the user. Hence, trust is naturally multidimensional, which in turn prevents us from quantifying it. Although it is legitimate to assume that information security issues and individual perceptions of access are correlated to the "trust" individuals feel towards on-line environments, this assumption does not necessarily entail a cause-effect relationship. Consequently, SIBIS refrained from any attempt to measure "trust." Nevertheless, measuring individual perceptions of security and privacy over the Internet is significant because they are indirectly connected to the development of trust in the on-line world. Clearly, concerns about privacy and data security, and perceptions of the security and accessibility of a website, have implications on citizens' usage of the site.

Access barriers are elements that can impede individuals' participation in the Information Society. However, measuring the relevance and effect of these barriers is extremely difficult, because they are primarily perceived as such by the individual alone. Indicators on "access barriers" presented here focus on the perceptions about website accessibility of non-regular Internet users and non-users. Some might consider their lack of skills as the chief impediment to accessing the Internet; others will perceive access costs as a burden too high to overcome; others still, might deem the low usability of websites, or the simple fact that 'the Internet is not for me' as a reason for remaining excluded.

Figure 11 below, shows that citizens are strongly concerned both about privacy/confidentiality and data security, with a slightly higher concern about privacy. Generally, among the NAS, concerns about privacy and confidentiality, as well as those about data security, tend to be lower than within the EU. However, looking at Member States of the EU, and at Accession Countries individually, both groups exhibit a great deal of variation. For example, Poland and Latvia are countries where both concerns register

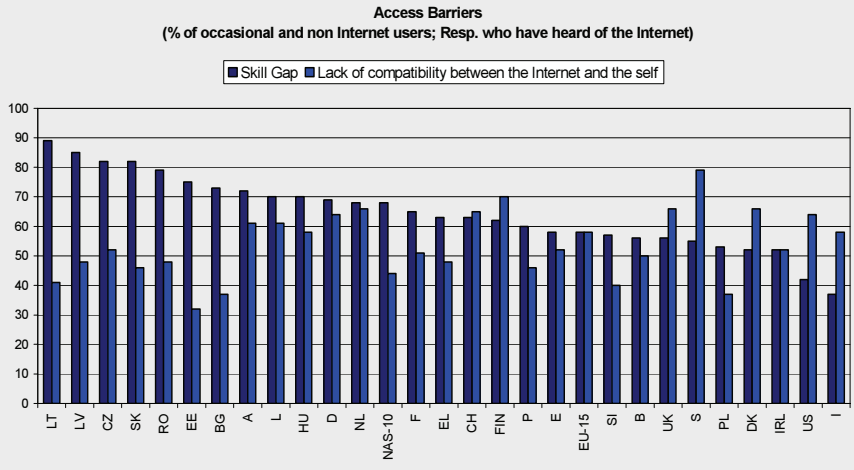
higher than in the EU. Similarly, in the Netherlands, France, Austria, and Sweden concerns about privacy and confidentiality are lower than in the Accession Countries as a whole.



Concerns (particularly on privacy) seem to be lower in continental Europe than in the UK, Ireland, or the US. Whether this is caused by a higher amount of negative experiences, more trust in the functioning of society-at-large, or the level of awareness is not yet clear. Among the NAS, concerns about privacy and confidentiality, as well as those about data security, tend to be lower than within the EU.

Figure 11– Concerns Regarding On-line Security
Base: all respondents, weighted

Although perceived and actual access barriers are contingent on individual circumstances, some barriers might be considered as relatively more important, while others might be more easily alleviated. Amongst a variety of possible self-perceived access barriers tested in SIBIS, the "skill gap"([12]) seems the most relevant in the European context to achieving a wider participation in the IS, while the lack of compatibility between the Internet and the self([13]) is a critical psychosocial barrier to going on-line. Figure 12 shows this information and considers respondents 'agreeing completely ' and 'agreeing somewhat' to the given statement.



Most non-regular internet users in Europe believe that advanced computing skills are required for using the Internet. However, while in the EU15 less than 60% feel the skill gap as a barrier to internet usage, this figure is 68% on average in the NAS10, reaching peaks of over 80% in Latvia, Lithuania, Czech Republic, and Slovakia. In contrast, psychosocial barriers to Internet usage are stronger in more advanced information societies (e.g. Sweden), suggesting limitations to the current growth in Internet penetration levels.

Figure 12– Barriers to Internet Usage: The Skill Gap and Lack of Compatibility Between the Internet and the Self
Base: EU15: Occasional and non-Internet users; NAS10: respondents who ever have heard of the Internet (incl. 'don't know'); weighted column percentages

(12) People saying that 'using the Internet requires advanced computer skills.'
(13) People saying that 'Internet is not something for them.'

Conclusions

Establishing trust in the security of on-line systems is a necessary component to the development of the information society. Among the EU Member States and the NAS, citizens expressed varying levels of concern regarding privacy and confidentiality, as well as about data security online. Although there appears to be a higher level of concern in the EU countries than in the NAS with respect to online privacy and confidentiality, there is a significant overlap in the level of concern expressed in the two groups of countries. Alongside with security and privacy concerns, many individuals feel that barriers to using the Internet exist and can be difficult to overcome. SIBIS data suggests that the perception of the Internet as necessarily requiring advanced computing skills is stronger in the NAS10 than in the EU15, while psychosocial barriers (i.e. the sensed lack of compatibility between the Internet and the self) is stronger in the EU15 where internet penetration is higher.

4.2 Digital Literacy, Learning, and Training

The concept of the Information Society and the pace with which it has been changing over the years have led researchers, policy-makers, and practitioners to believe that new skills are required. The Information Communication Technologies (ICT)([14]) industry is growing by the day with perceptible consequences on economies throughout the world. Moreover, ICT-related skills are key to peoples' effective use of technologies, which in turn is of interest to businesses wishing to successfully test their products. Last, the application of ICTs has also affected the demand for skills that are not related to ICTs themselves. These indirect effects result, in particular, from the shortening of product life cycles that is being enabled by technology. The intensity of research and development associated with creating new products has steadily increased. Competitive forces are bound to lead to a further acceleration of the process of translating innovation into marketable products and processes. As new products and processes are associated with new skill requirements, skill life cycles, too, have shortened and will decrease further in the future.

Since they are so important to economic and social well being, Eurostat, the Luxembourg-based statistical office of the EU, has been active in measuring skills' developments through an indicator on life-long learning derived from the Community Labour Force Survey (LFS). However, a chief problem here is given by divergent question wording in different countries. For instance, while the United Kingdom's LFS instrument takes care to include all types of training activities, the German questionnaire focuses exclusively on 'Fortbildungsmaßnahmen' (further education measures), a term which is generally reserved for formal training courses provided by the state for the unemployed, and which lead to a certificate if finished successfully. With the purpose of overcoming situations of this sort, and to provide a clear picture of the current situation in the field, SIBIS developed and piloted a number of indicators on skills and digital literacy in the information society, some of which will be presented in the following pages. While SIBIS identified *acquisition of skills*, *provision of skills* and *skill requirements* as the three areas of interest, this sections focuses primarily on the first two.([15])

The *acquisition of skills* can take place through work-related training, including training activities in view of a future occupation, self-directed learning, and e-learning (i.e. the use of electronic learning materials, whether on-line or off-line). SIBIS data suggests that, although the participation of the European labour force in work-related training and self-

(14) In this report, Information Communication Technology (ICT) and Information Technology (IT) are synonyms.

(15) SIBIS research on the third area ("skill requirements") addresses future needs as opposed to current SIBIS results. SIBIS suggests that the main work to be done in this area is harmonisation of existing concepts and terminologies that are being used in national studies on the issue, and would prepare for the required pan-European survey on IT skill requirements. Such a survey is needed to support EU policy-makers in their search for the right strategy on IT skills provision.

directed learning is not uncommon, significant differences continue to persist between nations. The US, the Nordic countries, and the Netherlands are the only countries where 30% or more of the labour force is involved in work-related training provided either by their company or by some other organisation. It is quite the reverse in the Mediterranean states and Portugal, where participation in work-related training does not exceed 20% of the labour force, while the Accession Countries generally lag even further behind, with some countries facing a mere 4-5% of participation (Romania and Bulgaria). In a number of cases, however, self-directed learning is far more common than formal training courses. In Germany more than twice as many people engage themselves in this form of learning as opposed to work-related training (52% vs. 25%). Romania, which appears as the ultimate "laggard" in work-related training, has a higher share of self-directed learners than Greece or France (Romania: 16%; Greece: 12%; France: 13%). In Austria, where 25% of the labour force participates in training provided by third parties, 48% engages in self-directed learning. Generally, where work-related training is already common (Nordic countries, US etc.), it is not distanced so much from self-directed learning.

In general, the participation in life-long learning([16]) in Europe is not insignificant. E-learning, however, is not as widespread, although, as can be expected, it is directly correlated to life-long learning. E-learning technologies comprise off-line applications such as learning programmes on CD-ROMs, as well as on-line applications, usually transferred via the Internet or company/university-internal computer networks. About 15% of the EU labour force is making use of e-Learning for work-related training, two thirds of which already use on-line applications.

A significant share of the labour force is participating in work-related lifelong learning. While not giving any information on the type, intensity, and field of these activities, the data shows that a high percentage of workers are in the process of preparing for the adaptation of skills to the fast-changing requirements which are a key feature of the IS. At the same time, e-learning can play a decisive role in delivering learning systems that meet the demands of today's workers - and the unemployed. The share of the labour force that uses e-learning is 15% on average in the EU, and 5% in the NAS, both of which is much lower than the 23% reached in the US.

Figure 13 – Use of Any Learning and e-learning
Base: Labour Force weighted

Figure 13 above presents the spread of life-long learning and e-learning in Europe and the US. As is apparent, certain countries lead the way (US, the Nordic countries, and the Netherlands), while others lag behind (most NAS). Moreover, part of the labour force that participated in life-long learning, and had access to a computer during the four weeks previous to the survey, was addressed on its participation to e-learning activities. Clearly,

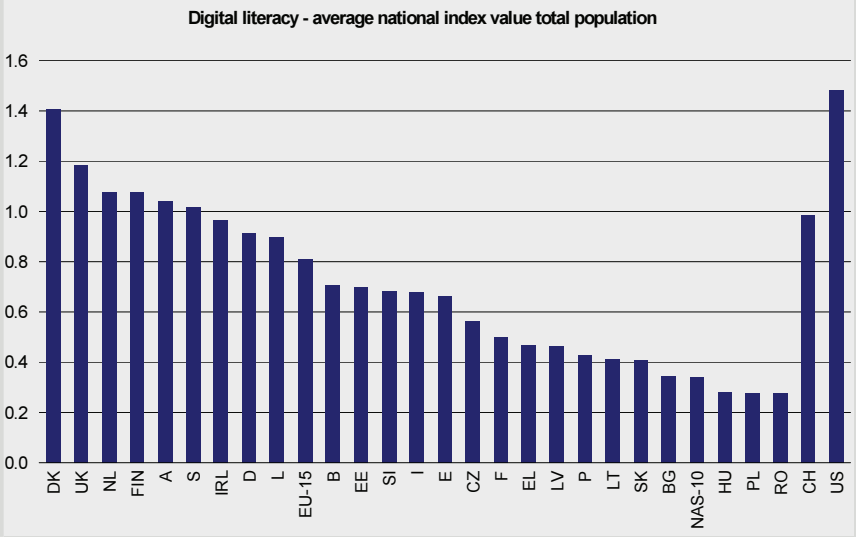
(16) Namely: self-directed learning and training provided by third parties such as employers, unions and pubic employment services.

where self-directed learning and formal work-related training are more pervasive, this is also true for e-learning. However, in certain countries, the gap between work-related life-long learning and e-learning is greater than in others. For example, while revealing a fairly extensive participation of its labour force in life-long learning (which surpasses almost half of the current EU states, including France and Belgium), the use of e-learning in Slovakia is limited, suggesting that, in spite of the labour force's willingness to learn continuously, and the provision of formal training by employers, unions, etc., the nation's electronic capabilities to prop these efforts are still inadequate.

The *provision of digital skills* on the labour market is generally referred to as Digital Literacy (DL). In a broader sense, DL also covers "soft" competencies which are not directly connected to ICTs, but are rather brought to the fore by the new technical possibilities of ICTs, and by the general development of the IS. SIBIS measured Europeans' and Americans' self-assessed(17) DL through four indicators relating to four types of skills in using the Internet. These include communicating digitally, obtaining and installing digital tools, questioning the source of information from the Internet regarding its reliability, and searching for the required information using search engines. The indicators are seen as different skills, which are all parts of digital literacy. They are all related to use of the Internet, but differ in character. Searching the Internet and sending e-mails are relatively uncomplicated activities when using programs with high user friendliness. Downloading and installing programs is more complicated, and demands a better understanding of how the software is structured. This interpretation is backed up by the General Population Survey (GPS) in which 90% of respondents were very confident in obtaining and installing software, and were very confident in communication. Only 40% of the very confident in communication were confident in obtaining and installing software. This indicates a growing complexity, as they are not sub-groups of each other. Some persons were very confident in obtaining software, but fairly confident or not confident in communicating via the Internet. The 'COQS'(18) index (Figure 14) combines these items into a single scale with a range from 0 to 3, with '0' representing the lowest possible digital literacy score and '3' representing the highest.

(17) Assessing skills directly would mean carrying out tests such as they are being used in the International Adult Literacy Survey, or the students' tests (such as the famous PISA study), both managed by the OECD. For timely data on fast-moving developments such as digital literacy, this approach is not feasible.

(18) Communicating, Obtaining, Questioning, Searching.



The overall average score on the COQS scale is 0.8 in the EU15 countries and 0.35 in the NAS, compared with the US score of 1.5. The level of digital literacy varies strongly within the EU, with the NAS in general as the ones showing the lowest level of DL among the total population. Estonia and Slovenia show a slightly higher level of DL than the Mediterranean countries of the EU and Portugal

Figure 14– Digital Literacy in Europe and the US
Base: All respondents weighted

Conclusions

There is widespread agreement that the introduction of ICTs as workplace technologies, and into all types of everyday applications, requires users to apply a new set of basic skills generally referred to as "digital skills." Hence, to be aware of the Information Society's developments, it is crucial to know how these skills are being acquired, and to what extent they are already in place.

SIBIS assumed the challenge of measuring European and American trends in learning and training, and in DL. The outcomes show that in some countries (US, Nordic countries, and the Netherlands) life-long learning and e-learning are far more common than elsewhere (NAS, the Mediterranean area, and Portugal). This finding is corroborated by the fact that the DL index (COQS) shows a similar country ranking. In other words, where life-long learning is common, DL (measured through the COQS index) is higher. Hence, it is reasonable to say that investing in life-long learning and e-learning is not in vain.

5 ON-LINE APPLICATIONS

5.1 e-commerce

E-commerce is a complex phenomenon whose specific definition can vary considerably. The definition endorsed by the OECD in April 2000 is now widely used by researchers, national statistical offices, and supranational statistical institutes like Eurostat. This definition focuses on the implementation of electronic transactions, either on Internet networks (narrow definition), or over any type of computer-mediated network (broad definition). The method by which the order is placed or received, not the payment or the channel of delivery, determines whether the transaction is an Internet transaction (conducted over the Internet), or an electronic transaction (conducted over computer-mediated networks). This definition implies that the simple process of gathering information on-line does not constitute electronic commerce: in order for electronic transactions to take place, it is necessary that at least the ordering step be carried out.

SIBIS analysis focused on the two main domains of e-commerce which are defined below.([19])

- Business-to-consumer electronic commerce (B2C) corresponds to "electronic retailing," i.e. any electronic trading transaction where the purchaser is the end user of the products and services procured.
- Business-to-business electronic commerce (B2B) refers to the implementation of electronic transactions between firms. The term B2B is, however, also often used to refer to on-line interactions between firms in a broader sense (e-business), including the management of various business processes (from planning and marketing to inventory control to ordering).

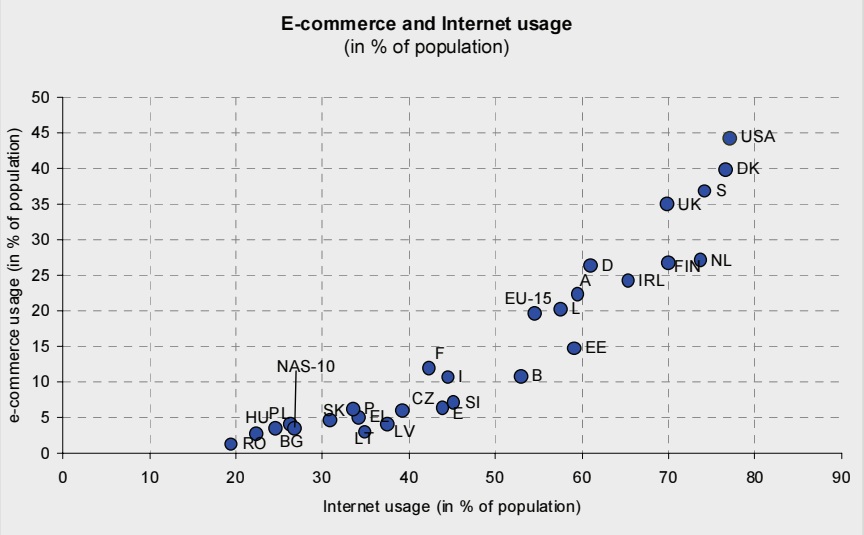
In the European member states, as part of the wider process of digitalisation of the economy as a whole, e-commerce is growing from the pioneer phase to increased integration within people's lives and companies' normal business practices. The US is the frontrunner, while most of the Accession Countries are just discovering e-commerce (Figure 15).

SIBIS data also demonstrates that occasional users of e-commerce services are representing an increasing proportion of the e-commerce users, especially in those countries with increasing on-line tenure([20]) and experience. The 25 to 49-age class are the most dynamic group of e-commerce users.([21])

(19) E-commerce also includes electronic transactions between businesses and government (B2G), which are part of the e-government section (section 5.4, page 44). However, this section describes businesses' online sales to government (Figure 17).

(20) This is the length (in years or months) of online usage and experience.

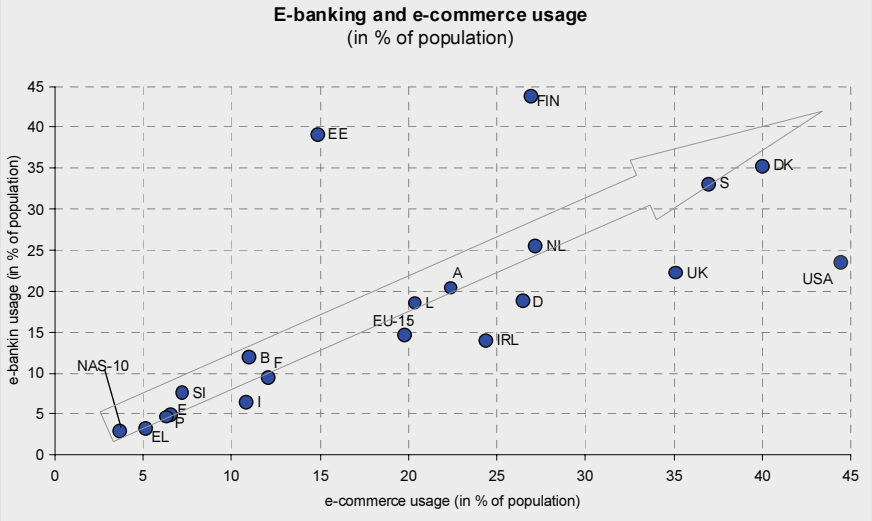
(21) For more details, see reference [16].



On average, 20% of the EU's population purchases products online. By comparison, for the Accession Countries only about 5 % of the population does so. On-line buyers tend to display a more interactive use of the PC than non-on-line buyers, suggesting that the more sophisticated Internet users purchase online.

Figure 15 – Internet Users and e-commerce: Ordering Products and Services Online
Base: all respondents, weighted

In Figure 15, e-commerce is defined as ordering a product or service online. Another, more or less comparable, important activity to be carried out on-line is e-banking, for example on-line banking or buying financial products online. As expected, e-commerce and e-banking usage are highly correlated, shown by the linear arrow in Figure 16, again suggesting that the more sophisticated Internet users are more inclined to use online services. However, one can argue that e-banking and e-commerce need to be considered separately, as everything depends on users' perception of trust towards the two online services, and one can imagine that individuals do trust their bank while they would not trust an online shop.

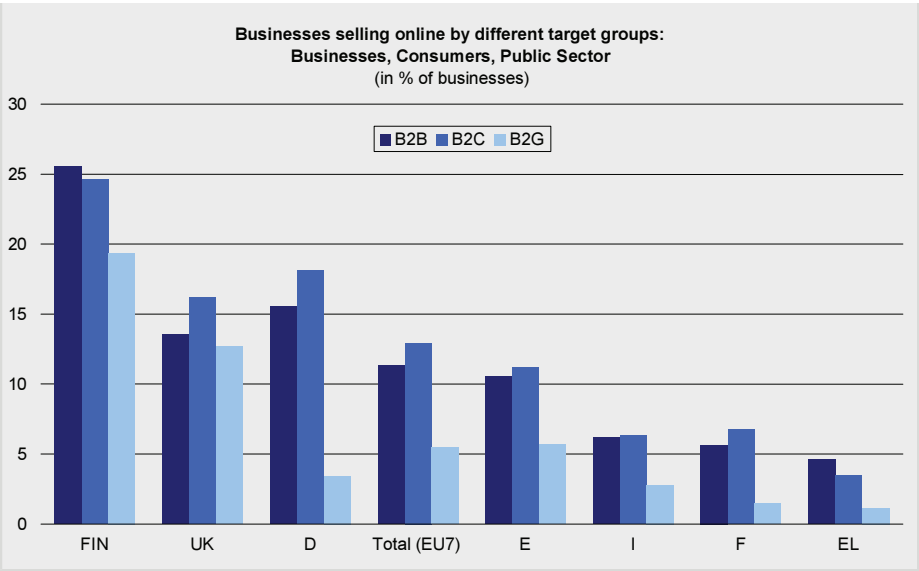


Some countries show considerable deviations from the linear arrow, like Estonia and Finland with their outstanding use of e-banking, and the US with high use of e-commerce but a bit lacking in the use of e-banking services. Among the NAS, Estonia is closest to the EU average with regard to e-commerce usage.

Figure 16 – People Who Have Ordered a Product or a Service (e-commerce users), or Have Conducted on-line Banking or Bought Financial Products (e-banking users)
Base: All respondents, weighted

Almost a quarter of Europe's businesses sell online, whether that is through a website or an e-marketplace, and twice as many make on-line purchases.

The on-line selling activity varies across the three market domains and across the countries analysed. B2B and B2C correlate closely in terms of on-line sales, whereas B2G is lagging behind.



On average, the volume of sales generated via e-commerce is small, and tends to form a small portion of total sales turnover. B2B sales equate to 12% of the total sales turnover, while B2C represents some 10% of the sales. Finland seems to have the most advanced on-line market among the countries surveyed.

Figure 17 – Share of Businesses that Sell on-line to Other Businesses, Consumers, and the Public Sector
Base: All establishments, weighted

SIBIS has developed a new typology of e-commerce that helps to indicate the levels of activity and integration into business processes. This typology classifies enterprises based on the type of transactions they carry out over the Internet, and the type of ICT services they employ (e-commerce typology). The typology is described below ([22]), and is illustrated in Figure 18 on the following page.

- *Offline:* Establishments without access to the Internet, e-mail and without a Website.
- *Basic online*: Establishments without a presence on the Internet (e.g. Website), but with access to the Internet or e-mail.
- *Web marketing:* Establishments with a presence on the Internet (e.g. Website), but none of the following.
- *Web sales:* Establishments that sell goods or services via the Internet (through own Website and/or via e-marketplaces), but none of the following.
- *CBNI - Closed Business Network Integration*[23]: Establishments that use Electronic Data Interchange (EDI) or Extranets for communication with forward or backward linkages in the communication network, but none of the following.
- *All round e-commerce:* Establishments that sell on-line as well as practice value chain integration.

(22) Note that the categories are mutually exclusive.
(23) Not conducting front office Internet activities.

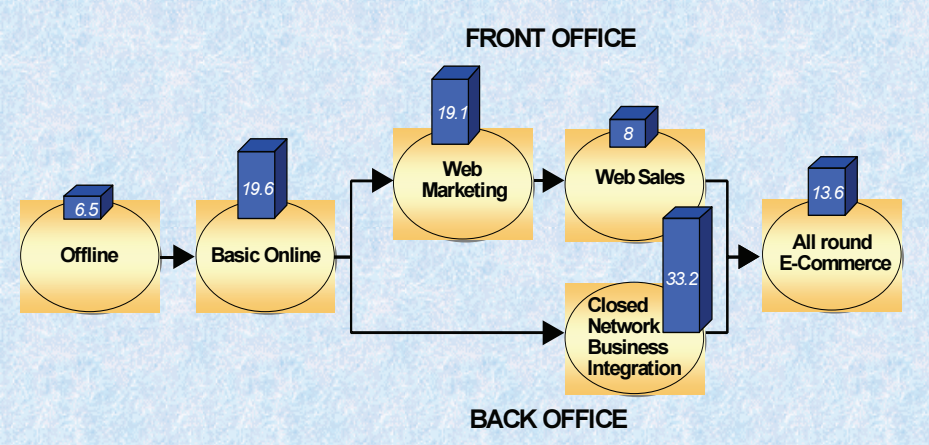


Figure 18 – Degree of Business Engagement in e-commerce (EU7, % of Business)
Base: all respondents; weighted by employment;

The survey results clearly show that European businesses vary widely in their levels of engagement with e-commerce. In the seven countries covered in the SIBIS establishment survey, only a very small minority of establishments (6.5%) remain completely off-line, although a further one in five companies only use basic e-mail. For one third of businesses (33.2%) in the countries surveyed, their e-commerce engagement involves back-office transactions through closed network business integration (based on the use of extranets or EDI). More than two in five businesses (40.7%) engage in some level of front-office e-commerce, with this being restricted to web marketing for one in five businesses (19.1%) and web sales for one in twelve (8.0%). Just under one in seven businesses (13.6%) engage in both front-office and back-office e-commerce. This advanced level of e-commerce is much more common in Finland and Germany, and is relatively rare in Greece and Italy.

Although the volume of e-sales and e-purchases are still limited, a majority of businesses declare that e-commerce has had a positive impact for them. E-sales judged to positively affect the quality of customer services, and the efficiency of the business processes and e-procurement, resulted in cost and efficiency benefits. However, quite a large number of businesses judge the impact to have been neither positive nor negative, or have difficulty estimating it.

Conclusions

To analyse e-commerce it is better to segment the market between occasional and frequent users, and focus on the second type. E-commerce buyers are, in fact, normally to be found among the more sophisticated Internet users.

Variations by country of the diffusion of e-commerce are still strongly influenced by the degree of readiness of each country's infrastructure and the consequent level of Internet penetration.

Concerning development of B2C e-commerce by country, in the future, its dynamics are likely to be influenced by a combination of Internet pervasiveness factors and retail market characteristics, including the maturity of on-line offers and characteristics of consumers' behaviour. Even if the Internet is a worldwide phenomenon, available data shows that commercial transactions tend to remain local or national, or European in the case of the EU and NAS. Since retail markets are still far from being completely global, national characteristics are likely to remain important for e-commerce development.

B2B is a more complex domain, where the understanding of the interaction between e-commerce innovation and existing business processes is still far from adequate, and therefore discussion on appropriate indicators is open and lively. The implications for market structure and business value chains are stronger here than in the case of B2C, but less understood. To examine B2B e-commerce, SIBIS segmented most indicators by sector (manufacturing, finance, distribution, & public administration); available surveys on e-commerce have established that differences by sector and business size are even more relevant than for ICT diffusion patterns. Moreover, SIBIS has developed a new typology of enterprises based on their degree of engagement in e-commerce for front-office and/or back-office activities. Results from the survey show that although most businesses in the countries surveyed are on-line in some form, e-commerce is still marginal. Despite this, a majority of businesses report that e-commerce has had positive impacts for them; a complication is that some have difficulty assessing what the impacts have been.

5.2 e-work

In recent years, policy-makers, businesses, researchers, and statisticians have become interested in the effects of ICTs on work. The implementation and exploitation of these new technologies has led to profound changes in the organisation of work (at a micro level) and in labour markets (at a macro level), and it has been suggested that the success of today's Information Society largely depends upon the ability of individuals, businesses, and governments to adapt to these changes (EC 2000). For this reason, the EU has been active in calling for improved statistics on IS-related issues such as ICT-enabled new ways of working, telework, work-related IT skills, employment in IT sectors, and occupations.

However, statistical information on these issues has been scant and seldom suitable for the task of informing policy-making, leading to uncertainty and confusion about the direction and intensity of developments regarding ICT-enabled new ways of working. With the purpose of shedding light on these issues, SIBIS developed and piloted a number of indicators on e-work, some of which will be presented in the following pages.

While SIBIS identified four work-related areas where statistics were required,([24]) and where the project could provide a valuable contribution to the current efforts of the European Statistical System (ESS) to develop new indicators, this section of the report focuses on indicators measuring changes to the flexibility of work organization via the application of ICTs. On a conceptual level the dimensions to consider when analysing flexibility developments regarding work organization are working time, the place of work, the type of contract, and the work content; namely the skills that are applied in the production process (Hofmann and Walwei 1999). SIBIS integrated these dimensions into a framework for developing indicators that cover current changes in the organization of work and in the structure of labour markets.

Arguably, it is on the location of work and the contractual underpinning of work where ICTs show their strongest influence. The former is affected by applications of ICTs, such as telework, mobile work, and tele-co-operation, which enable the separation of the location where work is carried out from the location where the work products are being integrated into the production process. The latter concerns, in particular, shifts from one sort of employment to another (for example from dependent employment to self-employment such as e-lancing). Additionally, the advent of the Internet has given way to observations that traditional employment relationships might become superfluous since transaction costs on the labour market are assumed to have fallen dramatically.

(24) These areas include (1) skills, (2) work organisation, (3) structure of work, and (4) outcomes of work. For more information about these areas, see the topic report on *Work, Employment, and Skills*, http://www.sibis-eu.org/ and section 4.2.

SIBIS measured the self-assessed impact of the hypothetical([25]) situation of not being allowed to work from home anymore on current EU([26]) home-based teleworkers. The results clearly show that telework is perceived to have beneficial effects on work performance, labour market participation, and geographical mobility. In the surveys, 23% of respondents state they could not do their job as well without the possibility of teleworking from home; 9% could not be in paid work at all; 15% would have to work less hours; and, according to their own assessment, at least 10% of all teleworkers would have to look for another job which is located closer to their home. This information, together with the measure of home-based teleworkers in the EU (7%, see below) allows an estimate of the actual effect of telework on the European Union's labour market: about 1% of all employed persons in the EU would not be in the labour force without the opportunity of teleworking from home.

Due to the impacts of telework, and because of the call for representative studies based on representative probability samples of the entire adult population, SIBIS surveyed citizens on their interest in and practice of telework, as well as on the feasibility of their job for telework.

Data suggest that, despite people's strong interest towards it, home-based telework is not common: just over 7% of workers from the EU, 3% from the NAS, and 17% from the US actually telework from home. However, it must be stressed that telework consists of a variety of types apart from home-based telework,([27]) including mobile work,([28]) centre-based telework,([29]) and self-employed teleworkers in a 'Small-Office-Home-Office' (SOHO).([30]) Hence, figures are higher when other forms of telework are also taken into account. Considering home-based telework, mobile work, and self-employed teleworkers in SOHOs, the EU average rises to 13%, the NAS([31]) to 5%, and the US to 25%.

Moreover, the averages, both for the EU and for the NAS, conceal significant differences among different states. In the EU, home-based telework is common in northern Europe (15-20%), but the Mediterranean area, together with Portugal, barely reaches 5% of intensity. Similarly, although telework is infrequent in the NAS, there are significant disparities between those countries that show a relatively high intensity of home-based telework (8% in Estonia and Lithuania, which are above the EU average), and the others (less than 5%) (Figure 19).

(25) A hypothetical question has been preferred against a more direct question asking for the effects of starting to telework, as it cannot be assumed that today's teleworkers have recently (or ever) worked in a traditional work setting. Only workers who have changed their work location, for example from a central office to their home, would be able to answer a question such as 'what effect has telework had on your work performance?' However, if telework were to become a mainstream way of working, the ability of respondents to give reliable answers to hypothetical questions of the kind above would decrease. Altogether, it seems that it will still take some time before telework becomes pervasive.

(26) NAS data is not available.

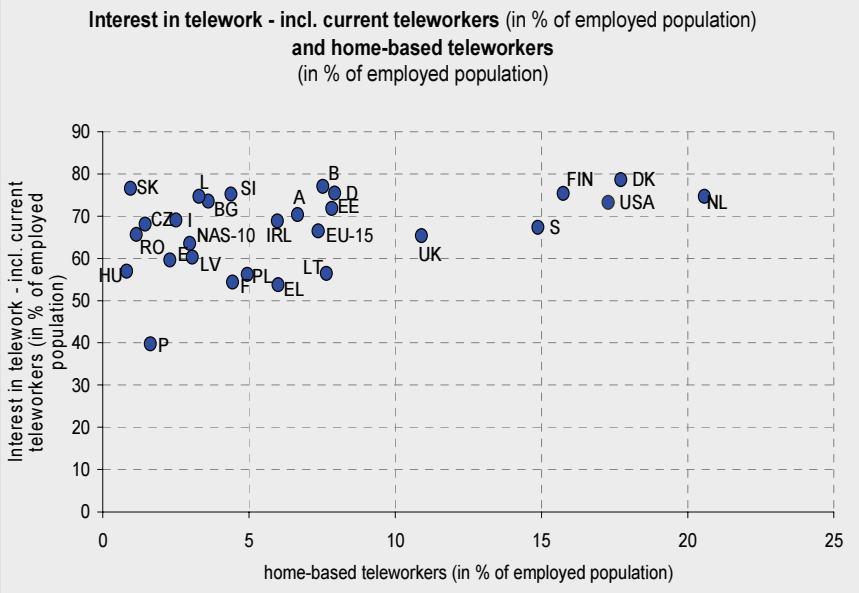
(27) Home-based telework implies a relocation of the workplace, for part or whole of the working time, from the establishment site to the home of the worker. According to the intensity of teleworking practice, home-based telework can be "supplementary" (when teleworkers work at home for less than one day per week), "alternating" (when teleworkers spend at least one full working day at home), and "permanent" (when teleworkers spend almost all of their working time at home).

(28) Mobile telework is the outcome of ICTs being used to either increase the locational flexibility, or enhance the productivity of mobile workers. Mobile teleworkers use online connections, especially e-mail, while travelling, which allows them to continue co-operating with members of staff at the central site (as well as external business partners), and stay closely integrated in the production process. Communication does not have to literally take place "on the move" (e.g. in a train), but can also occur at a hotel, on the customer's premises, or at some other (stationary) place.

(29) Centre-based telework includes telework which takes place in so-called 'telework centres' (tele-centres, tele-cottages etc), but it is not possible to differentiate this phenomenon from other types of co-located work, which heavily rely on ICTs for the transmission of work outputs, in a way that is sufficient for survey research (Gareis, K., (1999), 'Benchmarking Progress on Telework and Other New Ways of Working in Europe', *Proceedings of the Fourth International Workshop on Telework*, Tokyo, August 31st - September 3rd 1999, n.p.)

(30) Self-employed teleworkers in SOHOs are freelancers and other self-employed persons who work from a so-called small office, home office (i.e. their workplace is at the same location as their home), and transfer work inputs and outputs by electronic means. ICTs are being used for interaction with clients, collaborators, and suppliers.

(31) This is based on 9 NAS countries, excluding Latvia.



About 65% of Europeans and over 70% of Americans are interested in home-based or centre-based telework.([32]) Both in the EU and the NAS, the share of persons interested varies comparatively little between countries. The share of the working population teleworking from home, however, is far lower. On average, only 7% of the employed population in the EU, and 3% in the NAS telework from home, although in this case these averages mask major differences among states.

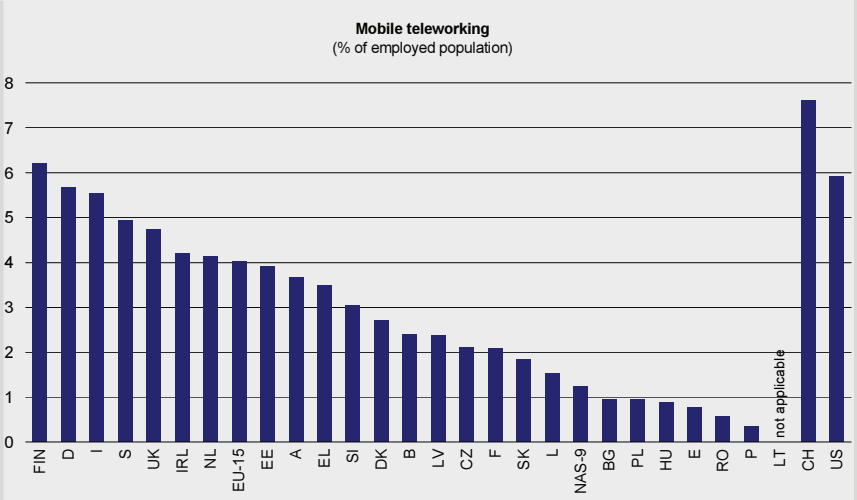
Figure 19– Interest in Telework and Home-based Telework
Base: all persons employed, weighted

While, as shown in Figure 19, there is no manifest correlation between employees' *interest in* and *practice of* telework, SIBIS highlighted the strong association between the use of the Internet medium, recognisably a key ingredient to a successful spread of these new ways of working, and the spread of home-based telework. Even though teleworking is not all about the Internet, the positive correlation between Internet usage and home-based telework is unambiguous: countries with low Internet usage, such as most NAS, the Mediterranean states of the EU, and Portugal, display a lower share of home-based teleworkers than countries such as the Netherlands, Finland, or Sweden, where Internet usage is more pervasive. Moreover, not only Internet usage directly relates to the extent of telework practice; it also relates to perceptions of non-teleworkers on the feasibility of their occupations for telework. Individuals from countries with low Internet usage and, therefore, limited teleworking, are less likely to deem their profession feasible for teleworking than persons from countries where Internet penetration is extensive. For example, Bulgaria, with just over 25% of Internet usage, has 4% of home-based teleworkers, 10% of non-teleworking employees believe their job would be suitable for telework, and 74% express interest in telework. In contrast, the Netherlands, with roughly 75% of Internet usage, have 21% of home-based teleworkers, 41% of non-teleworking employees believe their job would be suitable for telework, and 75% express interest in telework.

From what has been said above, it is fair to say that, in spite of the interest in telework, an extensive shift of work from the office into the home is yet to be seen. The reasons for this are only partly extractable from the data. Internet penetration unquestionably plays a role in making a job feasible for telework, but other reasons, such as the perceived need for face-to-face interaction with colleagues, customers, or other persons, seem to encumber the widespread practice of telework in Europe and the US. Although companies are often willing to give their staff remote access to their computer network, the acceptability of staff working from home whole days seems to be limited.

(32) SIBIS measured workers' interest in at least one type of telework among home-based telework, mobile telework, or centre-based telework but, because it is not possible to differentiate centre-based telework at a tele-centre from other types of co-located work relying on ICTs for the transmission of work outputs in a way suitable for survey research (Gareis, K. (1999) 'Benchmarking Progress on Telework and Other New Ways of Working in Europe', *Proceedings of the Fourth International Workshop on Telework*, Tokyo, August 31st - September 3rd 1999, n.p.), centre-based telework was discarded as a viable measure of the actual extent of telework.

This trend is complemented by the strong increase in mobile teleworking -- the use of on-line connections for work purposes during business trips. Here again, the technology is being put in place and increasingly used. The share of mobile teleworkers in the EU has grown from 1.5% to 4% in the course of only three years (ECATT([33]) 1999 vs. SIBIS 2002). This is likely to benefit employers, as the efficiency of business processes increases because of more continuous communication flows. The percentage of mobile workers (those who spend at least 10 working hours per week away from home and the main place of work, but do not necessarily make use of on-line applications while travelling) is over 11% in the EU. On average, shares are lower in the NAS, where just over 1% of all persons in paid work are mobile teleworkers, and 10% are mobile workers.

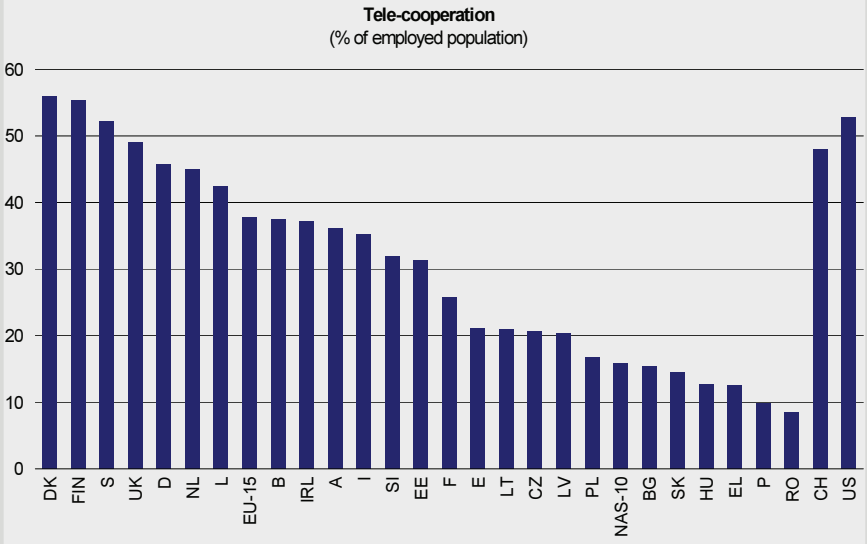


In the EU, 4% of persons in paid work are 'mobile teleworkers'. Shares are, on average, much lower in the NAS. The main purpose of mobile teleworkers to use on-line connections is sending and reading e-mail.

Figure 20 – Share of Employed Population Who Practice Mobile Teleworking in Europe and the US
Base: all persons employed, weighted

(Home-based) telework is usually singled out as the most significant ICT-related development with regard to working locations. However, tele-co-operation (the use of ICTs for direct contacts between workplaces at geographically distant locations) also plays a significant role in shaping the way the majority of work is performed (Figure 20). Its attractiveness stems from the fact that labour, as opposed to capital, is known to be the geographically immobile factor of production. Hence, the possibility to transmit products of work between locations of production, without moving the workers themselves, is welcomed by industry.

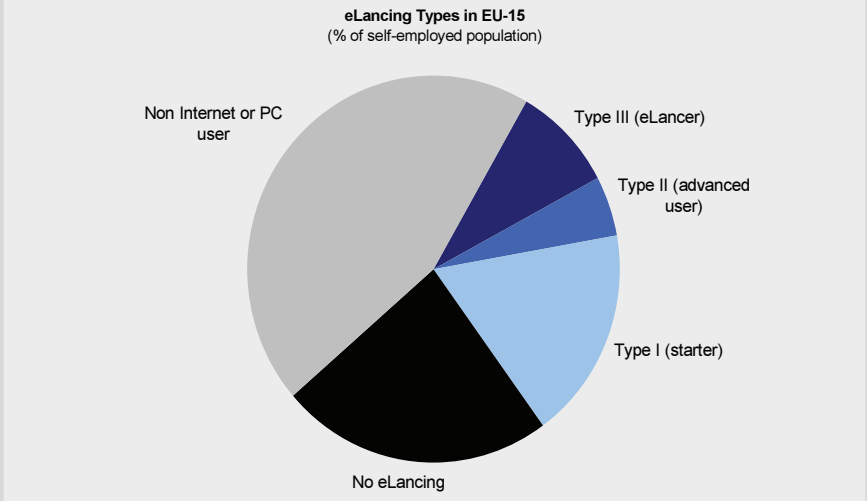
(33) ECaTT (2000) *Benchmarking Progress on New Ways of Working and New Forms of Business across Europe. Final Report*, Brussels: European Commission, DG Information Society.



Evidence suggests that, by allowing flexible configurations of human capital without actually moving people from one place to another, tele-co-operation boosts workers' productivity and innovative performance. Almost 38% of EU and 16% of NAS workers already practice tele-co-operation; 75% use e-mail at least once a day, and over 50% use electronic data transfer (EDT).

Figure 21 – Share of Persons in Paid Work Practising Tele-co-operation
Base: all persons employed, weighted

Together with impacts on the location of work, ICTs also stimulate shifts from dependent employment to self-employment, such as e-lancing. In the narrow sense of the term, e-Lancers are freelancers who "work on the Net"; that is, they carry out all communication with others (supplier, work partners and associates, clients, and customers) through the Internet or other computer networks.



In the EU, 9% of the self-employed are e-Lancers, 5% are advanced e-Lancers, and 18% are e-lancing starters. The share of e-Lancers is much higher in the United Kingdom (18%) and the US (14%), which appear to be leading the freelancer movement onto the Internet.

Figure 22 - e-lancing Types in EU15
Base: Self-employed population, weighted

For survey research, and based on the assumption that e-lancing in the narrow sense of the term is still unusual, SIBIS distinguishes between three degrees of e-lancing activity: e-lancing starters are self-employed workers who attract new business through ICTs *or* deliver work results to clients/customers through the Internet; advanced e-Lancers are self-employed workers who attract new business through ICTs *and* deliver work results to clients/customers through the Internet; and occasional e-Lancers (or simply 'e-Lancers') are self-employed workers who communicate with clients/customers exclusively by electronic means (Figure 22).

Conclusions

The exercise of developing new statistical indicators on e-work began with the argument that systems of production and labour deployment are changing because of the growing importance of information and knowledge vis-à-vis the traditional factors of production. Therefore, it is crucial to measure these developments constantly, adequately, and efficiently. The EU has endorsed this task by stressing repeatedly that the ability of individuals, businesses, and governments to adapt to ICT-enabled changes is a prerequisite for the IS to thrive.

Location and contractual bases are the aspects of work where ICTs have the strongest impact. The development of phenomena such as telework, mobile work, and tele-co-operation, and the shift towards ICT-enabled self-employment are visible changes from the past. SIBIS shows that: Europeans are rife with interest in telework but rarely practice it; the home is just one amongst many options for work re-location, and mobile teleworkers might soon outnumber home-based teleworkers; and over one third of EU citizens in paid work, and one in six in the NAS, tele-co-operate (through e-mail, EDT or videoconferencing). Moreover, the spread of the Internet has allowed freelancers in the EU to “move on the Net”: 9% of all EU self-employed people are occasional e-Lancers (i.e. a freelancer who communicates with clients exclusively by electronic means), but this figure increases up to 32% if advanced e-lancing users and e-lancing starters are also taken into account.

SIBIS data confirms that significant disparities exist among countries (as well as between the EU and the NAS) on indicators about employment structures in the IS. Some states (particularly the Netherlands and the Nordic countries) have high shares of employment in IT sectors and occupations, and high penetration rates of new ways of working, even in comparison with the US. Others lag behind, most notably the Mediterranean countries (with the partial exception of France), Portugal, and most NAS. When it comes to ICT-based new ways of working, there is some evidence to suggest that the differential between these countries and the forerunners has not decreased between 1999 and 2002. This implies that more effort might be needed to include all of Europe in the developing Knowledge Economy in order to make the EU the most competitive macro-region in the world by 2010.

5.3 e-science

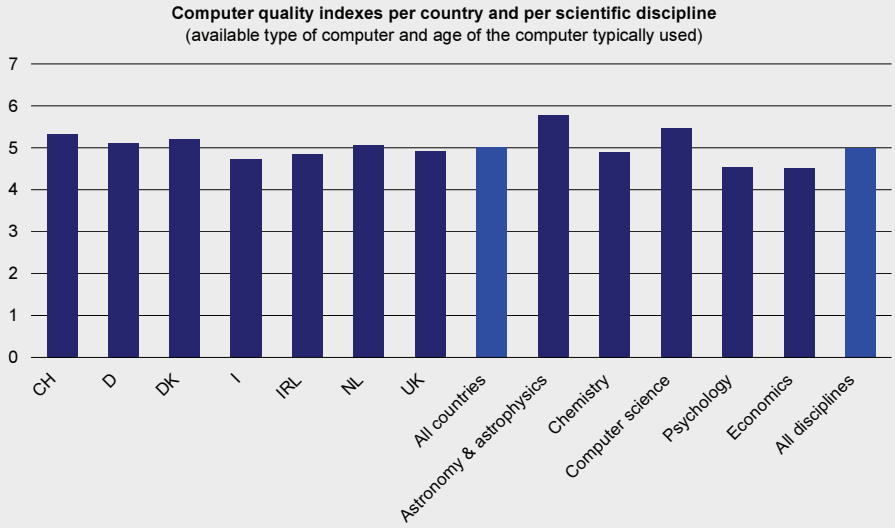
One of the key fields where the opportunities offered by the Internet play a crucial role is research. Research is a source of new knowledge, inventions, and technical progress; Internet technologies affect the degree to which it can meet this function. Researchers in some disciplines also can be considered as avant-garde ICT users in a work environment. Hence, exploring e-science should give clues about future ICT requirements and trends in other areas of society. The SIBIS topic “Internet for R&D” set out to benchmark the use of Internet technologies in European research systems. Although in principle research systems include academic and private sector research and development (R&D) establishments, SIBIS considered public science and defines e-science as its penetration with computers and computer networks. The focus of the empirical work covered five scientific disciplines (astronomy, chemistry, economics, computer science, and psychology), and seven countries (Denmark, Germany, Ireland, Italy, the Netherlands, Switzerland, and the UK).

The various constructs that fill the technology space, and the human-computer interaction space, of e-science can be structured along the lines of readiness, use, and impact.

Readiness for e-science includes indicators on the computer and network infrastructure in science, and the computer skills and IT awareness of scientists. Capable computers and networks with sufficient transmission capacities are the technical pre-conditions for e-science. Computer skills, and an awareness of the capacities of IT for knowledge production, are other, rather soft pre-requisites. Use of e-science includes indicators on a variety of purposes in science for which computer networks are employed. Internet-based applications have become integrated into such diverse activities as data collection and data analysis, information retrieval, communication, collaboration, and publishing. Some of the applications are especially useful in a certain phase of a research project, namely during planning and definition, implementation, or dissemination, whereas others are used during the entire duration of a project. Impact indicators assess on the one hand the production of new knowledge, effectively the main aim of science. In this area, indicators might cover different outcomes of scientific work, such as publications and patents. On the other hand, scientific collaborations can be affected by the use of Internet technologies. Hence, indicators on the occurrence of R&D collaborations, and the size of collaboration networks, are important.

Research networks are an important element of e-science readiness, as they determine the speed and quality of data and information transmission between different research sites. Available data on National Research Networks (NRN), their core capacity (the maximum data transfer rate per second available within the network), their congestion, and their budget size reveal an unclear picture. The Netherlands performs well for all indicators; some countries, such as Finland and Denmark, have attained a very good position, but are losing ground as a result of their diminished commitment towards further improvement; others, (notably Spain and Belgium) are catching up. Greece, Ireland, and Portugal lag behind with low transmission capacities and relatively large congestion levels. Larger countries (Germany, France, the UK, and Italy) are difficult to rate. Of course, they have above average backbone transmission capacities, but they also have many clients and users. The low budget figures might be caused by economies of scale, and the congestion levels are close to the EU average.

Besides ‘soft’ readiness indicators, relating to scientists’ computer skills and their awareness of the capacities of IT for knowledge production, SIBIS also measured the quality of currently used computer equipment. The types of available computers (stand-alone PC, workstation, mainframe, supercomputer, cluster of PCs), and the age of the computer used, are the most important indicators to assess the quality of computer equipment. An index created accordingly, shows that whereas national differences do not play a significant role here (as opposed to the NRN-related measures), discipline-related divergences are far more pronounced. Figure 23 below shows this index.

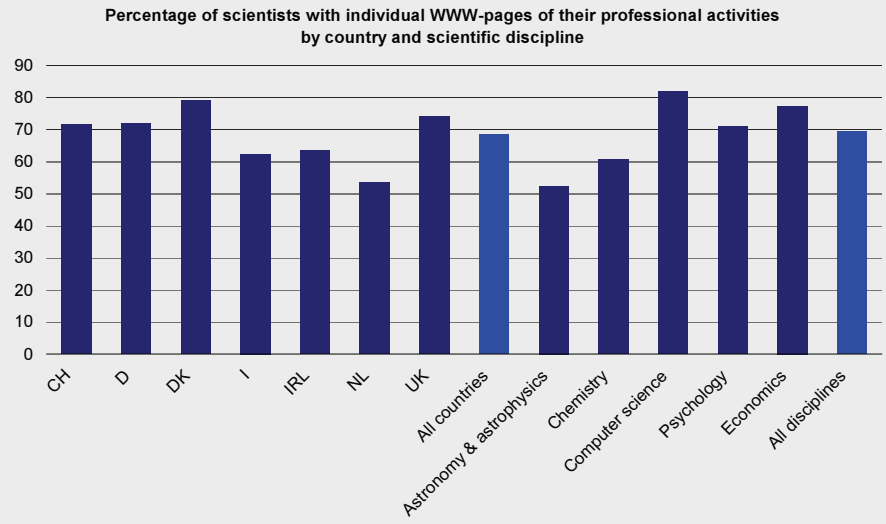


In general, the country differences are not very pronounced. For this set of readiness indicators, the differences between scientific disciplines are much more pronounced than the differences between countries. Astronomers and computer scientists appear the most 'e-science ready'. Chemists are usually at, or a little bit below, the average of all scientific disciplines in the dataset; economists and psychologists rate the readiness indicators worse than the average scientist.

Note: Responses for countries are weighted by research discipline in order to control for the effects of different sample compositions.

Figure 23 – Computer Quality Indexes Per Country and Per Scientific Discipline
Base: Respondents to the SIBIS R&D survey (1458 scientists)

SIBIS assessed to what extent scientists do in fact use e-science tools for their work, either for data collection, analysis, information retrieval, or diffusion of results. Also, in this respect, country differences, even though revealing a patchwork of strengths and weaknesses, are less marked than discipline-related differences. In general, Danish scientists make more use of the World Wide Web for dissemination and collaboration than their counterparts from other countries; in Ireland the use of e-science lags behind overall; and in the Netherlands, personal web-pages are comparatively unimportant for disseminating information. Differences related to specific disciplines are also notable and typically in line with the e-science readiness picture. Figure 24, however, shows an exception to this overall tendency: astronomers generally use the Internet most often for collecting and analysing data, and retrieving information; but, as the figure shows, they do not rely on personal WWW pages for publishing professional information. On the other hand, a much higher percentage of economists, normally not the avant-garde of e-science, and computer scientists have their own WWW pages. This points to scientific communication models that differ in regard to how they integrate Internet applications, in this case the World Wide Web.



About 70% of the respondents had an individual web page of their professional activities and competences. This percentage is significantly highest in Denmark (79.2%) and lowest in Netherlands (53.5%). The discipline differences are as notable as the country differences: 81.9% of the computer scientists and almost the same percentage of the economists (77.4%) have a web page, whereas only 52.4% of the astronomers and 60.7% of the chemists have one. This is particularly notable, as, generally, astronomers are the strongest users of e-science tools.

Note: Responses for countries are weighted by research discipline in order to control for the effects of different sample compositions.

Figure 24 – Percentage of Scientists with Individual WWW-pages of Their Professional Activities by Country and Scientific Discipline
Base: Respondents to the SIBIS R&D survey (1458 scientists)

The impact of computer networks on science can be analysed by looking at the outcomes of R&D (publications, citations of publications, patents), and the collaboration activities of scientists, as ICTs are supposed to support particular communication and collaboration in science. Previous scientific analyses have tested, at the micro-level, the hypothesis that Internet applications not only increase the productivity and raise the output of scientific research, but also usually generate other positive effects.([34]) The SIBIS results provide a basis for conducting such analyses at the macro-level.

Conclusions

E-science is the penetration of public science with computers and computer networks. SIBIS measured various aspects, focusing on readiness for, use and impact of, e-science. In many instances, readiness for and use of e-science are similar across countries. Yet, this is not the case when we compare across disciplines: astronomers and computer scientists are clearly the most “ready” for, and top “users” of, e-science. The SIBIS study in this area has been fruitful, and produced for the first time comparable data for various countries and scientific disciplines. It has also highlighted some key elements that previously lacked any measurement, but ought to be developed further. One future area would be analysing causalities: astronomers might use e-science applications more than other scientists because they collaborate to a large extent, and have to bridge the distances from their collaborators; but computer networks might also have supported the further growth of collaborative activities. It is clear that the indicator system and the available data cannot yet be considered comprehensive, and further research is needed on a variety of issues such as in the case of large versus small NRNs, or sub-national RNs.

(34) See also reference [2].

5.4 e-government

The growing interest in how to exploit emerging technologies (ICTs) to build customer relationships and deliver services is not a concern for the private sector alone. Since the mid 1990s, governments([35]) have also been active in studying and developing new ways to reach out to their citizens. The electronic facilitation of these relationships between governments and the users of their services has become known as *e-government*, and includes any transaction involving the government that is carried out, even partially, using electronic means.

Due to the importance of these recent developments, it has become crucial to adequately measure to what extent e-government is taking place and is being chosen by citizens as the preferred way to interact with the public sector. A number of other existing studies([36]) explore the availability, level of sophistication, and usage of on-line services. However, these analyses focus almost exclusively on the supply side of e-government, while failing to draw attention to users' perceptions of, and preference for, the services. The few studies that address the question of citizens' preference for e-government overlook what compels citizens towards or away from e-government. Additionally, studies of the business preferences for e-government, or existing means of transaction, are non-existent. SIBIS complemented these efforts by addressing the demand side of e-government, and by asking businesses about their preference for on-line transactions with government. Hence, the focus here is chiefly on *Government to Citizens* (G2C) and *Government to Business* (G2B).([37])

The increased role of governments in the every day life of citizens and businesses means that the range of services provided is very extensive. Examples of areas where government and citizens or businesses communicate include, among others: access to laws, rules, and regulations; information on parks and recreation; personal and corporate income taxes; unemployment or disability compensation; social security; personal documents; car registration; application for building permits; declarations to the police; public libraries; change of address announcements; census bureau surveys; corporate taxes; new company registrations and submission of data to statistical offices. This list is by no means exhaustive and serves to illustrate areas where e-government has or will make its presence felt.

SIBIS has chosen seven services as particularly representative of the areas where interaction with governments occurs, namely: car registrations, declarations to the police, personal documents, searches for books, changes of address, job searches, and income tax declarations.([38])

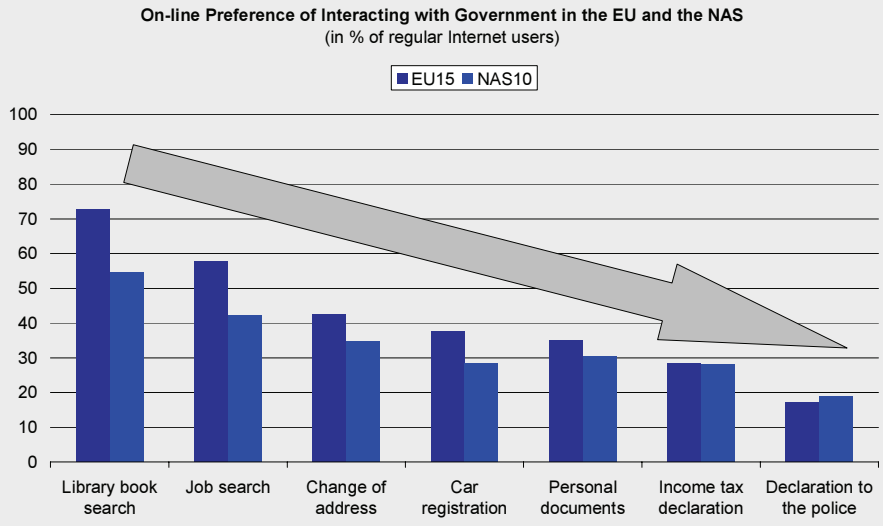
Figure 25 below illustrates that the demand for on-line access, as an alternative to traditional access to government services, varies across services. It is apparent that European regular Internet users would rather turn to the Internet for communicating with their administrations if it did not involve revealing a great deal of personal information (clearly a declaration to the police entails renouncing one's privacy far more than a library book search or a job search).

(35) Since European countries strongly differ in terms of institutional organisation (some are federal, others even lack local authorities), the term 'government' is understood as any public authority which offers certain services, and with which citizens and businesses interact. Hence, 'government' comprises the local, regional, and national levels (and increasingly the supranational too).

(36) For more details, see reference [8].

(37) It was not possible, within the scope of SIBIS, to look at interactions between governments (so-called G2G).

(38) The selection is a subset of the 12 public online services for citizens as defined by the European Commission, and which are seen to be of interest for contributing to what other indicators already cover but only partially fulfil the needs from a policy perspective.



EU and NAS citizens demonstrate a significant preference for some e-government services, while others still prefer the traditional way of doing things. The large majority prefer on-line searching for books in public libraries, which requires minimal information about the user. The lowest demand was for on-line declarations to the police, which require a great deal of private information be divulged. The amount of personal information required is only one explanatory factor for the preferences of citizens; for instance, familiarity with the on-line service, and experience using the Internet are also likely to play a role.

Figure 25 – On-line Preference for Government Services Among Regular Internet Users in the EU and the NAS
Base: Regular Internet users, weighted

The preference for e-government varies across countries. Typically, in countries where Internet usage is higher, citizens prefer to communicate on-line with their governments. However, the enthusiasm towards e-government does not always ensue from its actual implementation or from citizens' on-line access. Romanian regular Internet users are the most keen to communicate with their government over the Internet, in spite of substandard Internet penetration levels and e-government services availability; similarly, notwithstanding lower Internet usage than its Dutch and Danish neighbours, Germany is more eager to use public on-line services. Figure 26 below shows the preference for e-government services citizens would like to use, based on the seven services considered by SIBIS. When a country does not rank high this does not by definition reflect inactivity in deploying e-government services, but it can indicate a different approach with a set of priority actions that are not included in the SIBIS measurement, like e-voting for example.

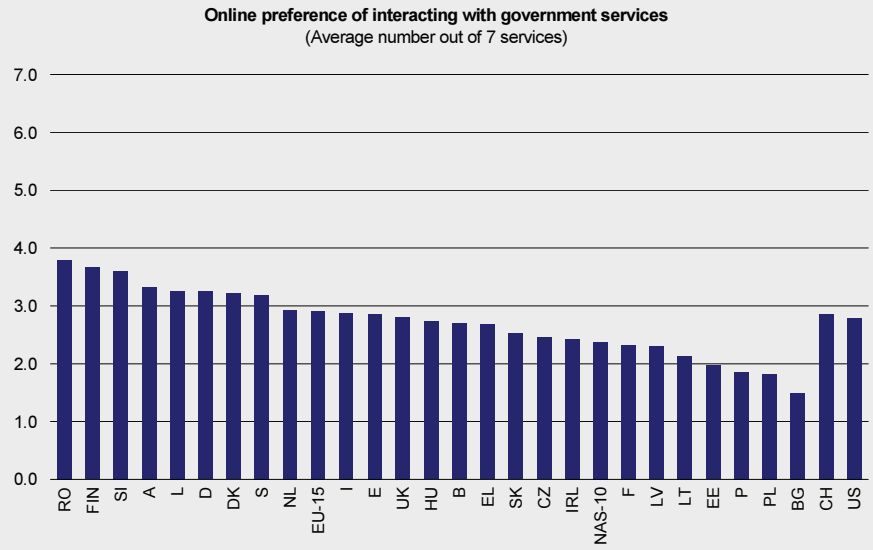
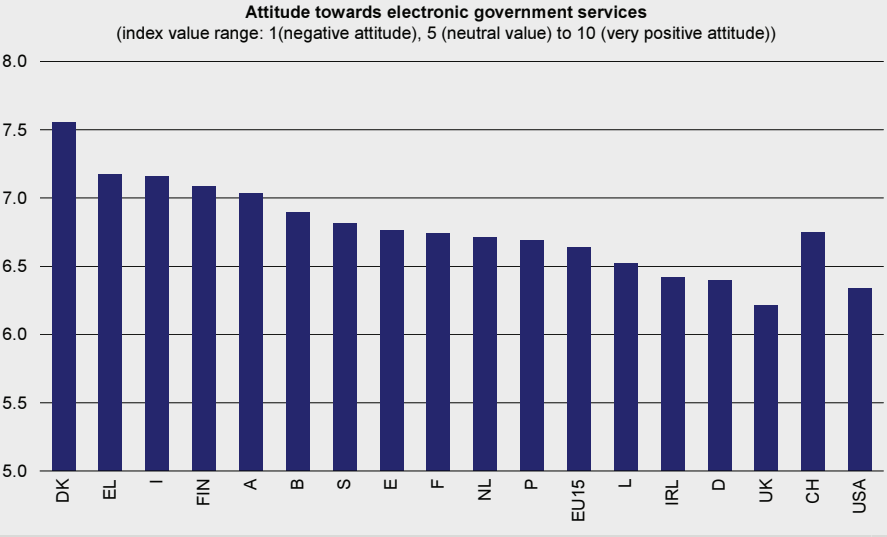


Figure 26 – On-line Preference of Interacting with Government Services
Base: Regular Internet users, weighted

Overall, respondents from EU countries prefer to use the Internet when interacting with government for an average of almost three of the seven services listed. In the NAS, Romania shows a very high ranking, well above the average of the Accession Countries, and higher than all EU member states. Yet, availability and usage of those services in Romania is low: Romanians are very willing and enthusiastic about the possibilities the Internet can create for them in the future.

Besides preferences for certain e-government services as opposed to traditional government services, the *attitude* towards e-government in general remains positive. Through the development of an index founded on the agreement or disagreement with a number of statements on the advantages of electronic government services, SIBIS assessed the attitude towards e-government across the EU.([39]) On a scale of 0 to 10, all EU countries, the US, and Switzerland rank more than 6, where values above 5 indicate that people have a positive attitude towards electronic government services.



The value of the 'Attitude index' ranges from 0 to 10. A value between 0 and 5 means that people do not see the advantages of, or are unfamiliar with, e-government services; a value of 5 means that people are indifferent towards e-government. A value between 5 and 10 means that people have a positive attitude towards e-government. Clearly, all citizens have a positive attitude and see the advantages of e-services, with the Danish showing the greatest enthusiasm.

Figure 27 – Attitude Towards Electronic Government Services in the European Union Members States, Switzerland, and the US
Base: Regular Internet users, weighted

(39) It was not possible to construct a similar index for the NAS because the relevant questions on advantages and disadvantages of on-line public services were not included in the SIBIS+ survey.

Finally, e-government also encompasses communications between administrations and businesses (this is the so-called G2B). Companies may wish to submit data to statistical offices, pay social contributions to employees, or participate in public invitations to tenders over the Internet. Research prior to SIBIS([40]) reveals that these types of on-line services for businesses are often available and more sophisticated([41]) than on-line services for citizens. Yet, SIBIS results indicate that more than 50% of the IT managers surveyed do not use these services, and between 10% and 20% do not know if those services are used within their company.([42]) Moreover, the willingness to use these services is also low: approximately one third of IT managers not currently accessing government services on-line would prefer to carry out these transactions on-line.

Conclusions

The electronic medium is key to the progress and improvement of government services in Europe and the world. Increasingly, states understand that they can use ICTs to interact with their citizens more efficiently, speedily, and with greater efficacy. The implementation of electronic service delivery by the public sector is generally called e-government, and includes G2C, G2B, and G2G. Overall, SIBIS found that the people of Europe and the US clearly enthusiastic about e-government, but none the less ready to reject it if they felt their right to privacy was being jeopardized (for example by requiring a great deal of personal information to be divulged, like in the case of a declaration to the police). At the same time, the preference for e-government is not a direct consequence either of a population's Internet penetration, or of the actual availability of services over the net. As the case of Romania illustrated, there might be a strong potential for the development of e-government where Internet usage and service availability notably lags behind the average. Finally, for G2B to have greater positive effects, more needs to be done to promote the use of these services (often already available) to businesses, as many seem to be either unaware, or have a negative idea, of interacting on-line with their administrations.

5.5 e-health

The e-health domain is very broad and complex, due in part to the wide variety of players involved. These include government departments, health administrations, insurance agencies, pharmaceutical companies, large hospitals, health clinics, imaging and laboratory facilities, individual doctors in hospitals, clinics or their own offices, other paramedical professionals and staff, administrative personnel, and, of course, individuals moving between the roles of citizen, patient, and career.

Another element of complexity derives from the variations in the ways that healthcare systems are organized in different countries, with varying mixes in terms of public and/or private provision and utilization, and whether or not general practitioners play a gatekeeper role in determining access to other services. There are also significant variations in the ways that services are delivered, and in what is deemed acceptable or good practice.

E-health does not just comprise accessing medical information, but it also involves many different dimensions and legal implications, such as the possibility of conducting remote medical tests. In addition, social concerns and liability aspects hamper developments as much as technological issues.

(40) For more details, see reference [8].
(41) The more sophisticated a service is, the more it has progressed towards full electronic handling, see reference [8].
(42) The relatively large number of people who answered 'don't know' can be due to the fact that the IT manager may not be the person responsible for interacting with government on those type of services.

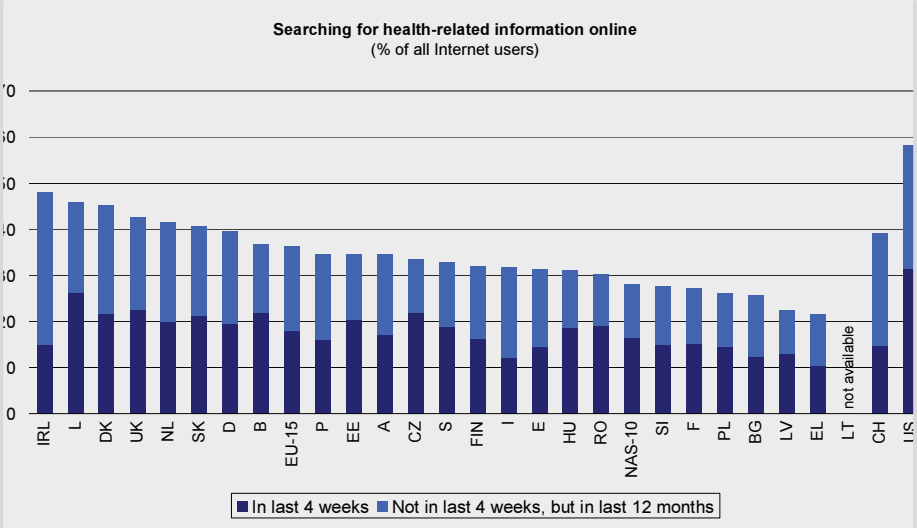
Proliferation of on-line e-health services (information, advice, clinical services, and pharmaceutical sales) is facilitating increased self-directed, self-servicing activity amongst consumers. If policy positions and initiatives are to be well informed and up-to-date, it is important to have indicators of both the availability and quality of such services, and of the use (and possible misuse) of such services. It is also important to monitor the extent to which such services, and their usage, affect health and healthcare divides across social groups; for example, do they result in better health practices, and do they reduce or increase the health differentials that currently exist across socio-economic groups?

There are also many opportunities for increasing the efficiency and effectiveness of the more "traditional" (i.e. off-line) health services through exploitation of the new opportunities presented by Information Society Technologies. Indicators are needed for benchmarking the extent to which these opportunities are being realized, and for illuminating the types of policy initiatives that may be needed to encourage the diffusion of good practice.

In line with the stated project objectives of linking with the e-Europe initiative, the SIBIS work on e-health focused particularly on indicators for benchmarking the e-health activities of both the general public and healthcare providers. These two are the priority areas for benchmarking identified in e-Europe 2005. However, in recognition of the broader scope of the e-health domain, the project also devoted some effort to collating candidate indicators for other healthcare players, such as educational institutions, insurers/reimbursers, and administrations.

The focus of actual indicator testing and benchmarking in SIBIS was on e-health activities of the general public - whether as citizens, as patients, or in the context of providing care for other family members - and specifically on usage of the Internet to search for health-related information. This is one of the most frequent activities on the Internet, and has profound implications for the organization of healthcare and for public health.

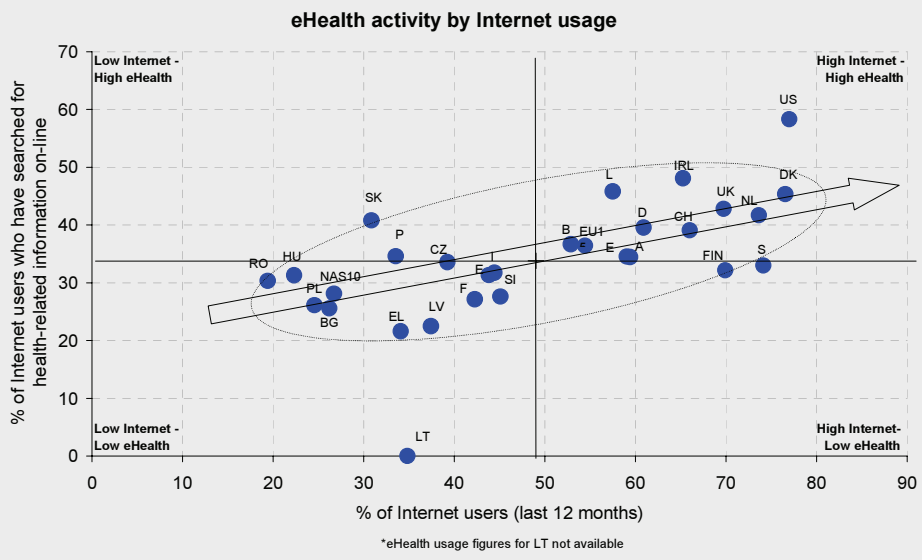
On-line searching for health related information is of growing importance within the repertoire of health-related activities of the European public, and consequently for health policy in Europe. European Internet users are less likely than their US counterparts to have reported using the Internet (for their private purposes) to search for health-related information. Within Europe, the prevalence of reported on-line health information seeking amongst Internet users varied considerably across the countries, with the highest rates in Ireland (48.1%) and the lowest rates in Greece (21.6%) (Figure 7).



A little over one third of Internet users in the EU (36.4%), and nearly 30% in the NAS reported on-line searching for health-related information during the 12 months reference period. However, on-line searching for health information is more prevalent in the US than in the EU. More than half (58.3%) of US Internet users reported this form of e-health activity.

Figure 28 –Search for Any Health-Related Information on the Internet Amongst Internet Users
Base: All Internet users, weighted column percentages

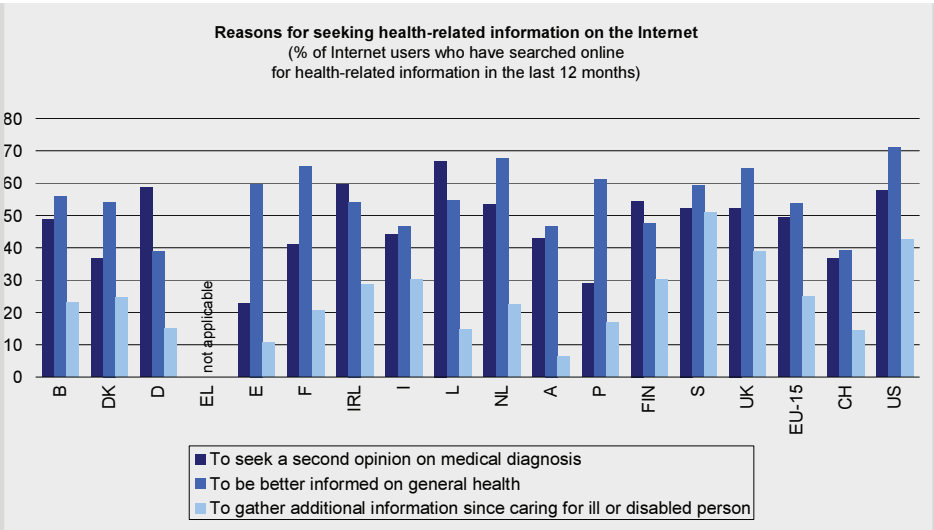
There is a significant trend towards increased levels of e-health activity by Internet users in countries with higher levels of Internet penetration, though some countries deviate notably from the general trend (Figure 29). Relevant factors in these differences might include a higher orientation towards, or necessity for, self-management of one's health in the US as compared to the Nordic countries with their generally well-developed public health services. Confirmation of this hypothesis, however, would require further specific studies.



US Internet users have an especially high propensity towards engaging in on-line health activity, while Internet users in Finland and Sweden have a lower propensity for on-line searching for health information than might be expected based on basis their Internet penetration levels. Slovakia, with a relatively low Internet penetration ratio, also shows a remarkably high propensity to search for on-line health information.

Figure 29 – Internet Penetration Levels and Propensity for On-line Searching for Health Information
Base: All Internet users (last 12 months), weighted

Within the EU, about half of those who searched on-line for health-related information did so to get a second opinion on a medical diagnosis. Such trends will pose increasing challenges for policy, both in regulation of the quality of information on the Internet, and in helping healthcare providers and their patients to benefit from the new possibilities for sharing decision-making.



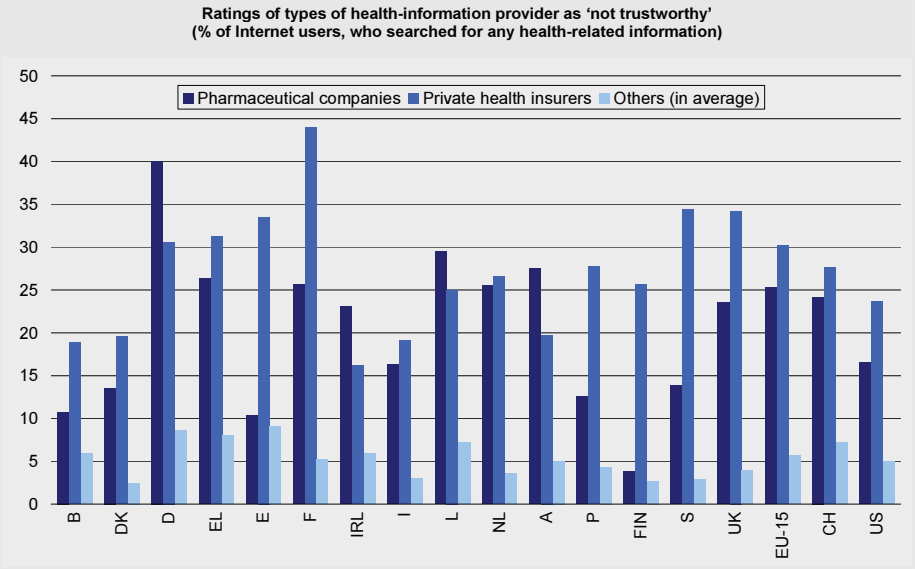
Amongst Internet users who did report searching on-line for health-related information, getting better informed on one's general health was the most commonly cited reason. This was closely followed in Europe by seeking a second opinion on a medical diagnosis. Fewer cited as a reason support of their role as one who cares for an ill/disabled person.

Figure 30 – Reasons for On-line Searching for Health-Related Information Amongst Users
Base: Internet users, who have searched on-line for health-related information, weighted column percentages

In general, Internet users within the EU([43]) who used on-line searching for health-related information reported such searches to have been successful. The vast majority (more than 90%) said that they were able to find health-related information on the Internet, and of those who found information, the vast majority (more than 90% again) judged it to be suitable for their needs. Taking both aspects into account (being able to find health information at all and, if so, being able to find suitable information), there was relatively little variation across countries, with the lowest overall success rates reported in Italy (80.5%), and highest in the UK (89.9%).

More respondents in the EU (15.5%) than in the US (2.6%)([44]) reported that they had to expand their search to non mother-tongue websites in order to find the information they needed. Within Europe, a variety of factors may affect tendencies to extend searching to non mother-tongue web sites, including whether one is from a majority or minority language group, the amount and quality of information available in the user's main language, and the language skills of the user.

In both the EU and the US, private health insurance companies and pharmaceutical companies were far more likely than other organizations (universities, hospitals, professional associations, and patient advocacy groups) to be rated as untrustworthy sources of information by those who searched on-line for health-related information. Around 30% in the EU and 24% in the US rated private health insurance companies as not trustworthy, and 25% in the EU and 17% in the US rated pharmaceutical companies as not trustworthy. Interestingly, as shown in Figure 31, within the EU there was quite a lot of variation in these ratings across the Member States. Some of these differences may be explained by contextual factors (for example "private" health insurance in Ireland has been, until recently, synonymous with a single state-regulated provider), but others warrant more detailed exploration in future studies in the area.



Germans were particularly likely (40.1%) to rate pharmaceutical companies as not trustworthy, while Finns were least likely (3.8%) to do so. The French were most likely (43.9%) to rate private health insurance providers as not trustworthy, while the Irish were least likely to (16.2%).

Figure 31 – Perceived Trustworthiness of Providers of Health-Related Information
Base: Internet users, who have searched on-line for health-related information, weighted

(43) There is no NAS data available.
(44) This is from within the percentage of people who have searched and found health-related information on the Internet

Conclusions

Although on-line searching for health-related information is still a minority activity in Europe amongst Internet users, it is of sufficient scale to represent a significant issue for public health policy in general, and for patient-doctor interaction in particular.

If such activity is judged to be a positive development in public health terms, then the EU lags behind the US in the extent to which the general public are utilising or benefiting from the new opportunities. People in the EU are less likely to be Internet users in the first place and, when they are, they are less likely than their US counterparts to search for health-related information online.

Language is an important factor to be considered in e-health policy. If linguistically determined health divides are to be avoided, it will be necessary to ensure that sufficient quality information is available for all language groups.

About half of those in the EU who have searched for health-related information on the Internet have done so to get a second opinion on a medical diagnosis. This provides the first robust quantification of the many anecdotal reports of patients becoming more informed, and more questioning, of the diagnoses and therapeutic recommendations of their doctors. It underscores the need for public health policy in Europe to support patients and doctors in exploiting the new opportunities for sharing health management and decision-making in a positive and synergistic manner.

Those who used the Internet to search for health-related information in the EU and the US were less trusting of pharmaceutical companies and private health insurers as sources of information than they were of other sources. Within Europe, there were quite wide variations across countries in whether or not, and to what extent, users expressed scepticism about these information sources. In relation to other sources of information, users tended to be a little more sceptical of patient advocacy/self-help groups than they were of healthcare organizations, professional associations, and universities. This type of information on user attitudes provides valuable insights that can be used for future work in developing quality criteria for health web sites, and on educating users to be discerning in their information search.

The work of SIBIS makes an important contribution to the state-of-the-art in e-health benchmarking in Europe, and provides a basis for further benchmarking based on multi-method approaches.([45]) In the future, surveys of the various healthcare players will be an important component, and dedicated surveys that allow more in-depth treatment of the e-health topic will also be of considerable value. Good quality, contextual data on the healthcare systems within which users are operating will be important for interpreting the results of such surveys. Other approaches will also be needed, including web scanning to objectively identify and describe the variety of e-health services that are now available and being used. Finally, automatic monitoring of site usage, in order to collect data on usage patterns, might provide important data, though careful attention to privacy issues will be crucial if such methods are to be considered.

(45) See reference [18] for more details.

6 CONCLUSIONS

In Europe, the focus of the Information Society has evolved from concentrating on basic issues such as access and infrastructure, to more complex issues of e-readiness, both for businesses and for citizens. As participants in the IS become more adept and sophisticated in their use of the new medium, such as in the case of e-commerce, intensity and impact indicators will tend to supplant readiness indicators as the appropriate measure of progress. For this reason, SIBIS was conceived with the aim of measuring the developments of the IS by combining the three levels of IS development: readiness, intensity, and impact. In addition to the EU Member States, SIBIS focused on the US, Switzerland, and ten Accession Countries.

In addition to telecommunications, topics of research were selected with the eEurope2002 action plan in mind. As the project moved forward, and the new eEurope2005 action plan became available, new areas were included in the SIBIS surveys. In addition, the countries of interest to SIBIS expanded because of the new accession of 10 east European countries. Questionnaires were compiled to survey the general population as well as decision makers in businesses about availability, usage of, and preference for Internet services, as well as about attitudes toward the IS.

The results of the surveys point to important aspects of the IS that provide a necessary complement to existing measures of progress in the IS. Up to now, evaluations of the IS have focused primarily on the supply side, looking at whether services are available and how sophisticated they are. SIBIS measures whether the services are used, to what extent, and why or why not. It is fair to say that, because of SIBIS, we have today a clearer picture of how Europe is progressing towards becoming the most competitive and dynamic economy of the world. This is true for e-commerce and e-government, for example.

Significant differences in piloted indicators were found among the countries surveyed. For this reason, generalizations about IS indicators might misrepresent differences between, for example, EU and Accession countries. In this way, significant differences in the mean level of readiness in the Accession countries and the EU countries points to a large digital divide between the two groups. However, a more careful analysis of the data that considers each country individually reveals widespread differences within the two groups and, at times, significant overlap between them.

Across the various dimensions that SIBIS considered, certain countries, although not always the same ones, lead the way. Likewise, some countries tend to lag, although they too are not always the same ones. Without posing the question of how geography may influence the development of the IS, SIBIS reveals regional differences. For example, overall, the US leads the way, with high Internet penetration and experience. Northern Europe, however, often has even higher figures. In another case, SIBIS shows that overall eastern Europe still has a long way to go to reach current EU levels, although, as noted, significant differences were measured between the eastern European countries so that the leading countries there performed better than the lagging countries of the EU.

The purpose of SIBIS was to test and pilot indicators; these should be used in larger, more comprehensive surveys. The results obtained are very promising, although they still present certain limitations. For example, because of limited budget availability, and not to overload interviewees, only a relatively limited number of respondents were interviewed and the questions used followed a nested structure. This complicated analysis, because in some cases it was impossible to know what additional information might have been gained from the survey by asking the question to all instead of only those who gave a selected response to earlier questions. This issue is considered in greater detail in other SIBIS

products - in particular the Indicator Handbook – where the “best” indicators are given – even when these were not the ones actually tested.

SIBIS provided useful insights into differences between regions (such as the EU vs. Accession Countries), as well as between individual countries. Based on an examination of PC and Internet participation of respondents, SIBIS highlighted factors that are associated with a digital divide existing between citizens of the EU Member States and those of the Accession Countries. Groups at risk of missing out on the development of the IS most likely include the elderly or those with a relatively low level of education, among others. However, considering these factors, and depending on the type of survey used, in the future SIBIS may have been unable to reach those groups that are falling behind, and was thus unable to learn about the barriers that prevent their full participation in the IS.

Some factors in the success of the IS play a prominent role across many areas of study. Information and network security are increasingly recognised as crucial elements for ensuring wide participation in the IS. Their impact is clear in areas such as e-commerce and e-government. While the importance of a secure information infrastructure was not disputed, before SIBIS, data on such issues was scarce. Although some attempts to measure issues of information security (such as occurrence of breaches, their seriousness etc.) had been made, most were not focused on the EU and the Accession countries, and were typically conducted on-line, thus excluding persons with limited Internet access. SIBIS represents a first attempt in this direction, specifically targeting European and US citizens and organisations through telephone-assisted or paper and pencil interviews.

Enhancements in on-line security are crucial to fostering on-line trust, which in turn is a necessary support for companies’ efforts to increase their on-line transaction activities. Hence, the measurements of Business-to-Consumer (B2C) intensity and of security are correlated. Moreover, information security management, as well as technical solutions, are necessary conditions for the establishment of a successful and fully compliant on-line commercial activity. It is clear then, that information security is a pivotal element for prompting the delivery of services and goods on-line, as also shown by indicators measuring self-assessed impacts of on-line sales and purchases. Finally, information security is also essential to support new forms of interactions between employers and employees through processes and applications such as telework or on-line training facilities.

Aside from the effects of trust on e-commerce, concerns regarding data security and privacy on-line can also be symptomatic of people’s trust towards on-line environments. At the outset of this project, SIBIS argued that the specific issue of “trust” was not suitable for benchmarking. In other words, it did not appear possible to measure “trust” as such because it is a subjective perception on the part of the user. Hence, trust is naturally multidimensional, which in turn prevents us from quantifying it. Although it is legitimate to assume that information security issues and individual perceptions of access are correlated to the “trust” individuals feel towards on-line environments, this assumption does not necessarily entail a cause-effect relationship. Consequently, SIBIS refrained from any attempt to measure “trust.” Nevertheless, measuring individual perceptions of security and privacy over the net is significant because they are indirectly connected to the development of trust in the on-line world.

There is widespread agreement that the introduction of ICTs as workplace technologies, and into all types of everyday applications, requires users to apply a new set of basic skills generally referred to as “digital skills.” Hence, to be aware of the Information Society’s developments, it is crucial to know how these skills are being acquired, and to what extent they are already in place. SIBIS developed and piloted a number of indicators on skills and digital literacy in the IS.

Indicators on e-commerce reveal that it is better to segment the market between occasional and frequent users, and focus on the second type. E-commerce buyers are, in fact, normally to be found among the more sophisticated Internet users. Variations by country of the diffusion of e-commerce are still strongly influenced by the degree of readiness of each country's infrastructure and the level of Internet penetration. Looking at development of B2C by country, its future dynamics are likely to be influenced by a combination of Internet pervasiveness factors and retail market characteristics, including the maturity of on-line offers and characteristics of consumers' behaviour. B2B is a more complex domain, where the understanding of the interaction between e-commerce innovation and existing business processes is still far from adequate, therefore discussion on appropriate indicators is open and lively. The implications for market structure and business value chains are stronger here than in the case of B2C, but less understood.

SIBIS also developed and piloted a number of indicators on e-work. The exercise of developing new statistical indicators on e-work began with the argument that, because of the growing importance of information and knowledge vis-à-vis the traditional factors of production, systems of production and labour deployment are changing. Thus, it is crucial to measure these developments constantly, adequately, and efficiently. The EU has endorsed this task by stressing repeatedly that the ability of individuals, businesses, and governments to adapt to ICT-enabled changes is a prerequisite for the IS to thrive.

One of the key fields where the opportunities offered by the Internet play a crucial role is research. SIBIS set out to benchmark the use of Internet technologies in European research systems. Although in principle research systems include academic and private sector research and development (R&D) establishments, SIBIS considered public science, and defines e-science as its penetration with computers and computer networks. Additionally, the focus was on five scientific disciplines (astronomy, chemistry, economics, computer science, and psychology).

Available data on National Research Networks (NRN), their core capacity (the maximum data transfer rate per second available within the network), their congestion, and their budget size show an unclear picture. Besides "soft" readiness indicators, relating to scientists computer skills and their awareness of the capacities of IT for knowledge production, SIBIS also measured the quality of currently used computer equipment. An index was created accordingly. SIBIS assessed to what extent scientists do in fact use e-science tools for their work, either for data collection, analysis, or diffusion of results. Country differences, even though revealing a patchwork of strengths and weaknesses, are less marked than discipline-related differences.

The impact of computer networks on science can be analysed by looking at the outcomes of R&D (publications, citations of publications, patents), and by looking at the collaboration activities of scientists, as ICTs are supposed to support in particular communication and collaboration in science. Previous scientific analyses have tested the hypothesis that Internet applications not only increase the productivity and raise the output of scientific research, but also usually generate other positive effects

The SIBIS study in this area has been fruitful and highlighted some key elements which previously lacked measurement, but ought to be developed further. One future area would be analysing causalities: astronomers might use e-science applications more than other scientists because they collaborate to a large extent, and have to bridge the distances from their collaborators; but computer networks might also have supported the further growth of collaborative activities. SIBIS neglected to account for this sort of interpretation. Additionally, it is clear that the indicator system and the available data cannot yet be considered comprehensive, and further research is needed on a variety of issues such as in the case of large vs. small NRNs, or sub-NRNs.

The e-health domain is a very broad and complex domain, in part because of the wide variety of players involved. Another element of complexity derives from the variations in the ways that healthcare systems are organized in different countries, with varying mixes in terms of public and/or private provision and utilization, and whether or not general practitioners play a gatekeeper role in determining access to other services. There are also significant variations in the ways that services are delivered, and in what is deemed to be acceptable or good practice.

In line with the stated project objectives of linking with the e-Europe initiative, the SIBIS work on e-health focused particularly on indicators for benchmarking the e-health activities of both the general public and healthcare providers. These two are the priority areas for benchmarking identified in e-Europe 2005. However, in recognition of the broader scope of the e-health domain, the project also devoted some effort to collating candidate indicators for other healthcare players, such as educational institutions, insurers/reimbursers, and administrations.

Although on-line searching for health-related information is still a minority activity in Europe amongst Internet users, it is of sufficient scale to represent a significant issue for public health policy in general, and for patient-doctor interaction in particular. If such activity is judged to be a positive development in public health terms, then the EU lags behind the US in the extent to which the general public are utilising or benefiting from the new opportunities. Language is an important factor to be considered in e-health policy. If linguistically determined health divides are to be avoided, it will be necessary to ensure that sufficient quality information is available for all language groups.

About half of those in the EU who have searched for health-related information on the Internet have done so to get a second opinion on a medical diagnosis. Thus, SIBIS provides the first robust quantification of the many anecdotal reports of patients becoming more informed, and more questioning, of the diagnoses and therapeutic recommendations made by their doctors. It underscores the need for public health policy in Europe to support patients and doctors in exploiting the new opportunities for sharing health management and decision-making in a positive and synergistic manner. Additional results obtained from SIBIS provide valuable insights that can be used for future work in developing quality criteria for health web sites, and on educating users to be discerning in their information search.

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8 ANNEX 1: METHODOLOGY

8.1 Methodology of the GPS 2002 Survey

The survey, using computer-aided telephone interviews, was conducted in April-May 2002 (interviews were carried out between 4th April and 18th May) in all 15 EU Member States, Switzerland, and the US. The survey was co-ordinated and executed by INRA Deutschland GmbH, Mölln. The population for this study comprised all persons aged 15 and over living in private households in the respective countries, and speaking the respective national language(s). In total, 11,832 interviews were successfully completed. The average interview length per country varied between 10 (Greece) and 20 minutes (Sweden).

Sampling: Target households were selected at random in all countries, either by random dialling techniques, such as permutation of final digits or by drawing a random sample from official sources. In most cases, a geographical stratification was implemented beforehand. For the selection of the target person, common random keys were applied in all countries except for the UK where a quota was used. In two cases (Spain and the US), screening had to be directed towards male respondents towards the very end of the field in order to gain gender representativeness.

There were three adjustments necessary in order to provide reliable data:

- **Transformation from household sample to person sample.** As only one person per household is interviewed, the described sample procedure provides a household sample, i.e. each household of the base population has the same likelihood of being in the sample, but not each person. With the weighting stage of the transformation the equal likelihood of households is replaced mathematically by the equal likelihood of the individuals. To this end, each data set is multiplied by the amount of people in the household aged 15 or over. This number is subsequently divided by the average household size in order to obtain the actual case

- **Adjustment of unweighted sample structure to the official statistic.** Since random samples are not evenly distributed across all population strata, the distribution of unweighted samples regularly, and systematically, deviate from the population distribution from official statistics. Through mathematical weighting, the sample distribution was adjusted to the official statistics. The national weighting factor, which results from the iterative weighting, was included in the data material.

- **Adjustment of weighted sample structure to the EU15 Member States population.** This weighting factor was necessary to calculate total figures according to the whole population of the EU Member States. Furthermore, it is useful to compare the EU with the US. Population sizes of each Member State are weighted to reduce the distortion based on the sample sizes in each country.

	Total		EU15	
	Unweighted	Weighted	Unweighted	Weighted
Total sample	11832	11832	10306	10306
Country				
B	585	585	-	-
DK	501	501	-	-
D	1001	1001	-	-
EL	505	505	-	-
E	1015	1015	-	-
F	1000	1000	-	-
IRL	500	500	-	-
I	1000	1000	-	-
L	500	500	-	-
NL	530	530	-	-
A	500	500	-	-
P	500	500	-	-
FIN	669	669	-	-
S	500	500	-	-
UK	1000	1000	-	-
EU15	-	-	10306	10306
CH	522	522	-	-
US	1004	1004	-	-

	Total		EU15	
	Unweighted	Weighted	Unweighted	Weighted
Age Groups				
Up to 24	1964	2019	1731	1651
25 to 49	5511	5309	4817	4593
50 to 64	2515	2495	2191	2209
65 and more	1833	2000	1558	1839
	9	9	9	14
Terminal Education Age				
Up to 13	695	717	693	728
14	715	742	701	881
15 to16	1794	1750	1641	1820
17 to 20	3587	3515	2997	2937
21 and more	3266	3275	2743	2495
Still studying	1687	1751	1463	1372
	88	81	77	73
Internet Usage				
Total Internet use	6905	6908	5828	5610
Regular use (last 4 weeks)	5944	5948	4985	4781
Occasional use (last 12 months)	961	960	843	830
Non Internet use	5550	5643	4655	4548

8.2 Methodology of the GPS-NAS 2003 Survey

The survey was conducted in January 2003 (interviews were carried out between 1st January and 31st January) in 10 Accession Countries: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia, using personal aided personal interviews (PAPI). The survey was co-ordinated and executed by NFO AISA Czech Republic, Prague. The population for this study comprised all persons aged 15 and over living in private households in the respective countries, and speaking the respective national language(s). In total, 10,379 interviews were successfully completed. The average interview length per country varied between 20 (Romania) and 40 minutes (Lithuania).

Sampling: Target households were selected at random in all countries, either by multistage stratified random-route sampling, or by drawing a random sample from official sources. Mostly a geographical stratification was implemented beforehand. For the selection of the target person, common random keys were applied in all countries, i.e. the next birthday method and the Kish method, except for Bulgaria where a quota was used.

There were three adjustments necessary in order to provide reliable data:

- **Transformation from household sample to person sample in Poland and Slovenia.** As only one person per household is interviewed, the described sample procedure provides a household sample, i.e. each household of the base population has the same likelihood of being in the sample, but not each person. With the weighting stage of the transformation, the equal likelihood of households is replaced mathematically by the equal likelihood of the individuals. To this end, each data set is multiplied by the amount of people in the household aged 15 or over.

This number is subsequently divided by the average household size in order to obtain the actual case number.

- **Adjustment of unweighted sample structure to the official statistic.** Since random samples are not evenly distributed across all population strata, the distribution of unweighted samples regularly, and systematically, deviate from the population distribution from official statistics. Through mathematical weighting, the sample distribution was adjusted to the official statistics. The national weighting factor, which results from the iterative weighting, was included in the data material.

- **Adjustment of weighted sample structure to the NAS10 countries population.** This weighting factor was necessary to calculate total figures according to the whole population of the Accession Countries. Furthermore, it is useful to compare the NAS with the EU. Population sizes of each of the ten states were weighted to reduce the distortion based on the sample sizes in each country.

	Total		*NAS10*
	Unweighted	Weighted	Weighted
Total Sample	10379	10371	10379
Country			
BG	104	1008	-
CZ	1096	1096	-
EE	1001	1001	-
HU	1000	1000	-
LT	1017	1017	-
LV	1006	994	-
PL	1000	1000	-
RO	1054	1054	-
SI	102	1002	-
SK	1199	1199	-
NAS10	-	-	10379-
Age Groups			
Up to 24	2036	1825	1736
25 to 49	4473	4604	4593
50 to 64	2402	2202	2234
65 and more	1468	1740	1816

	Total		*NAS10*
	Unweighted	Weighted	Weighted
Terminal Education Age			
Up to 13	374	433	575
14	658	682	855
15 to16	1099	1151	1099
17 to 20	4784	4816	4869
21 and more	1823	1833	1719
Still studying	1407	1213	1057
Never went to school	59	59	68
Don't know	175	184	138
Internet Usage			
Never heard of the Internet (incl. don't know)	1349	1437	1506
Ever heard of the Internet	9030	8935	8773
Total Internet use	3700	3507	2773
Regular use (last 4 weeks)	3025	2852	2215
Occasional use (last 12 months)	675	655	559
Non Internet use	6679	6864	7606

8.3 Methodology of the DMS 2002 Survey

The survey was conducted in March-May 2002 (interviews were carried out between 21st March and 15th May) in seven EU Member States using computer-aided telephone interviews. The survey was co-ordinated and executed by INRA Deutschland GmbH, Mölln. The population for this study is defined as all establishments belonging to four aggregated industry sectors in the seven Member States: Germany, Finland, France, Greece, the UK, Italy, and Spain. The interview was conducted with IT responsible persons in companies across all sectors of the economy. In total, 3,139 interviews were successfully completed. The average interview length per country varied between 14 (France) and 18 minutes (Italy).

Sampling: The sample was set up according to given industry and size class quota. Accordingly, a stratified random sample was drawn from the universe, allowing for the relevant industries within four aggregated sectors (manufacturing, construction, primary

sector; distribution, catering, transport & communication; financial & business services; public administration, education, health, and other personal and social services). Drawing the sample was organised locally by the national executing institutes.

Weighting: For the SIBIS DMS, a sample stratified by sector/ size cells was used which ensured that, in each sector, establishments from all size classes (1 to 9, 10 to 49, 50 to 199, 200 to 499, and 500+) were sampled. In order to be able to raise figures to the national level, some form of weighting was required to adequately reflect the structure and distribution of establishments (or related variables) in the universe of the respective country (and, by implication, EU15).

- **Original weight:** Within each country, the interviews were split according to a quota plan that guaranteed the sample was not dominated by micro and small companies. The quotas roughly reflect the distribution of employment over sector and establishment size bands in the EU, and derive from research into establishment sampling frames undertaken for previous studies by Infratest and GfK in the course of ECaTT. They represent best estimates, but do not take into account country differences. Weighting was used in cases where the quotas could not be reached exactly in line with this quota plan (mostly due to the limited absolute number of establishments in the two biggest size classes). Note that because of the use of a single quota plan for all countries, country differences in the distribution of employment over establishment size bands that occur in reality are not reflected in the data. This is due to the lack of available data on the distribution of employment across establishment size bands in almost all EU Member States, and constitutes a considerable problem. This weight is therefore not used for presenting SIBIS results.

- **Weighting by employment:** The data available on the distribution of employment over establishment size bands is very limited for most EU Member States. SIBIS used data from a variety of sources, including BT database (United Kingdom), ISTAT Industry and Services Intermediate Census (Italy), National Statistical Service of Greece (Greece), SIREN (France), Tilstokeskus Official Statistics (Finland), Heins + Partner B-Pool (Germany), and Schober Business Pool (Spain) and adjusted using data from the DG Enterprise/Eurostat SME Database (latest available, 1997), to estimate the establishment/employment structure for each country in the sample. Using this weight, the weighted sample for each country therefore reflects employee distribution between the five establishment size bands within that country. This means that a data reference of, for example, ‘20% of all establishments in country A,’ should be understood to mean ‘establishments accounting for 20% of all employees in country A’.

- **Weighting by employment for EU-7 averages:** Additionally another weighting factor was created to calculate average figures for all countries in the sample (which together represent roughly 82% percentage of total EU employment). Each country is represented in this weight according to its share in the total employment of the 7 EU countries in which the survey was conducted.

	Total	
	Unweighted	Weighted by Employment
Industry Sector		
Primary: manufacturing, energy, mining, construction	990	989
Secondary: distribution, catering, communication and transport	873	878
Third: financial and business services	502	501
Fourth: public administration, health, education, other social/ personal	774	772
Businesses with Internet Access		
Having access to the Internet	2785	2785
No access to the Internet	354	354
Security Breaches		
Establishments affected by security breaches in the last 12 months	514	552

	Total	
	Unweighted	Weighted by Employment
Total sample	3139	3139
Country		
D	512	512
EL	301	301
E	507	507
F	501	501
I	512	512
FIN	306	306
UK	500	500
Number of Staff at Site		
Up to 9	803	713
10 to 49	769	746
50 to 199	668	648
200 to 499	626	364
500 and more	273	668
Businesses with On-line Presence		
On-line presence	1857	1925
No on-line presence	1264	1190
Don't know	18	24

8.4 Methodology of the R&D Survey

The survey was carried out from April to July 2003 in six EU Member States and Switzerland. The survey was co-ordinated and executed by the University of Applied Sciences Solothurn Northwest Switzerland, and aided by the SIBIS partners. The population of the survey comprised individual researchers at public research organisations (universities, non-university research institutes, polytechnics/universities of applied sciences). In principle, a traditional (personal, phone, written), as well as a novel, Internet-based survey (e-mail or on-line questionnaire) would have been possible. However, as one of the main targets was to assess the usage of various Internet tools, an on-line survey might have suffered from a severe sample selection bias. Therefore, it was decided to carry out a postal survey for which a questionnaire with 48 questions was developed. All scientists in the sample received the questionnaire two times with a cover letter and a postage free (except for the UK) return envelope between April and July 2003.

Sampling: As comprehensive and comparable information on the structure of the population was not available, but at the same time various factors such as scientific discipline, position of the researcher (R&D manager, senior researcher, junior researcher), age, experience, and affiliation were assumed to affect the responses, only an exploratory survey was feasible. However, to control the variation in the sample, and allow for comparative analyses, five scientific disciplines were selected (astronomy, chemistry, computer science, economics, and psychology). A dataset size target of at least 30 scientists per scientific discipline in the smaller countries (Denmark, Ireland, the Netherlands, and Switzerland), and 40 scientists in the larger countries (Germany, Italy, and the UK) was chosen. Assuming a response rate of 20%, this led to sample sizes of 150 (200) researchers per scientific discipline and country.

Address collection: Addresses of researchers were retrieved by two methods. First they were gathered from scholarly associations at the European and national level (either from their published membership records, or from their internal address databases).([47]) Second, the remaining gaps were closed through address searches via the Internet, which employed the following procedure:

- **step 1:** random selection of research institutes (based on national or international Internet link lists for a scientific discipline);
- **step 2:** random selection of individual researchers from the staff lists of these institutes as published on their web pages.

One of the tables below gives an overview of the sample sizes per scientific discipline and country.

Response rate: Overall 1578 out of the 6518 respondents replied to the questionnaire and, because the respondent had died or left the organisation, 183 letters were returned. This leads to an overall net response rate of 25% (see the table below on the response rates by scientific discipline and country). Out of the 1578 responses, 69 declined to fill out the questionnaire, and 51 filled it out only partially, for instance, because they were not involved in R&D. The database for the empirical analyses therefore consisted of 1458 usable questionnaires. The address collection via scholarly organisations and the Internet left some insecurities in regard to the actual scientific discipline in which the respondents carried out their research. As the questionnaire also included a question on the three major disciplines of R&D, it was decided to use the responses to this question as the relevant information for attributing respondents to scientific disciplines. Only the core disciplines were included in the discipline-specific analyses.

Weighting: The information on the main scientific discipline of R&D was also used for calculating country and discipline-specific weights. Scientific disciplines affected the performance of e-science indicators to a large extent; variations of sample compositions by discipline would then lead to variations of the country values. To avoid this, each case received a weight that in total equalised the differing sample structures. See the tables below on the effects of the weighting on the dataset.

([47]) The following associations have to be thanked for their generous support: British Computer Society, European Association of Experimental Social Psychology, European Economic Association, German Informatics Society, Italian Chemical Society, and Swiss Association for Research in Information Technology.

Sample Size Per Country and Scientific Discipline (Discipline of the Address)

Country	Astronomy	Chemistry	Economics	Computer Science	Psychology	All Disciplines
D	200	200	276	300	239	1'215
CH	165	150	195	172	173	855
DK	107	164	157	152	124	704
I	200	221	260	200	251	1'132
IRL	101	150	170	151	91	663
NL	165	158	211	150	171	855
UK	214	200	203	252	225	1'094
Total	1'152	1'243	1'472	1'377	1'274	6'518

Response Rates Per Country and Scientific Discipline (Main Discipline of R&D)

Country	Astronomy	Chemistry	Economics	Computer Science	Psychology	All Disciplines
D	17.3	24.6	27.8	27.7	24.1	24.8
CH	27.7	33.6	33.3	34.9	35.5	33.1
DK	37.8	32.5	29.5	33.1	20.2	30.3
I	26.2	31.2	24.4	27.1	27.3	27.2
IRL	23.2	20.7	31.0	25.3	22.2	25.0
NL	20.9	27.2	17.1	11.0	15.8	18.3
UK	18.4	18.6	17.9	16.7	20.4	18.4
Total	23.3	26.7	25.4	25.0	24.0	24.9

Unweighted Responses Per Country and Scientific Discipline (Main Discipline of R&D)

Country	Astronomy	Chemistry	Economics	Computer Science	Psychology	Other Disciplines	All Disciplines
D	27	36	47	39	54	28	231
CH	24	43	54	67	54	36	278
DK	30	35	28	34	21	35	183
I	43	68	58	36	60	21	289
IRL	13	32	41	31	20	17	154
NL	23	35	36	14	24	12	144
UK	29	33	32	34	39	8	175
Other countries and missing	0	0	3	0	1	0	4
All countries	189	282	299	255	273	160	1458

Weighted Responses Per Country and Scientific Discipline (Main Discipline of R&D)

Country	Astronomy	Chemistry	Economics	Computer Science	Psychology	Other disciplines	All disciplines
D	38	42	44	36	43	29	232
CH	42	50	48	49	52	39	280
DK	33	31	28	30	26	36	184
I	46	56	58	47	56	21	290
IRL	20	31	30	30	22	21	154
NL	26	24	29	25	28	12	144
UK	33	33	35	34	34	8	177
Other countries and missing	0	0	3	0	1	0	4
All countries	242	266	273	254	263	166	1465

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